WRI INDIA

Confederation of Indian Industry
125 Years - Since 1895

Supported by: MacArthur Foundation

MSME TRAINING SERIES

#03: Energy Efficiency – Approach, Opportunities and Technology

28th January 2021| 3 PM – 5:15 PM IST

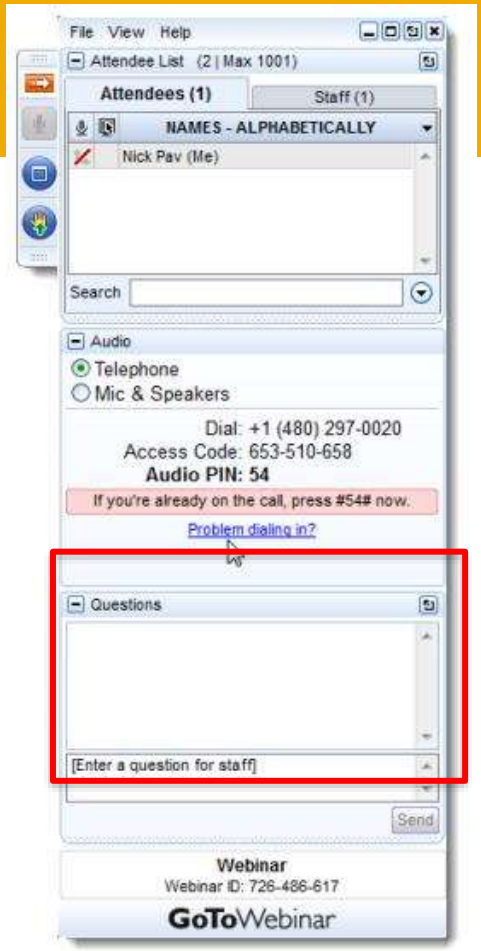
Image credit: Surya Prakash/unsplash

INTRODUCTION

Shubhangi Gupta, *Consultant, WRI India*

GUIDELINES

- Attendees will remain in listen-only mode.
- Today's presentation is being recorded and will be shared with registered participants.
- Please use the "Questions" pane to type in your comments or questions during the webinar.



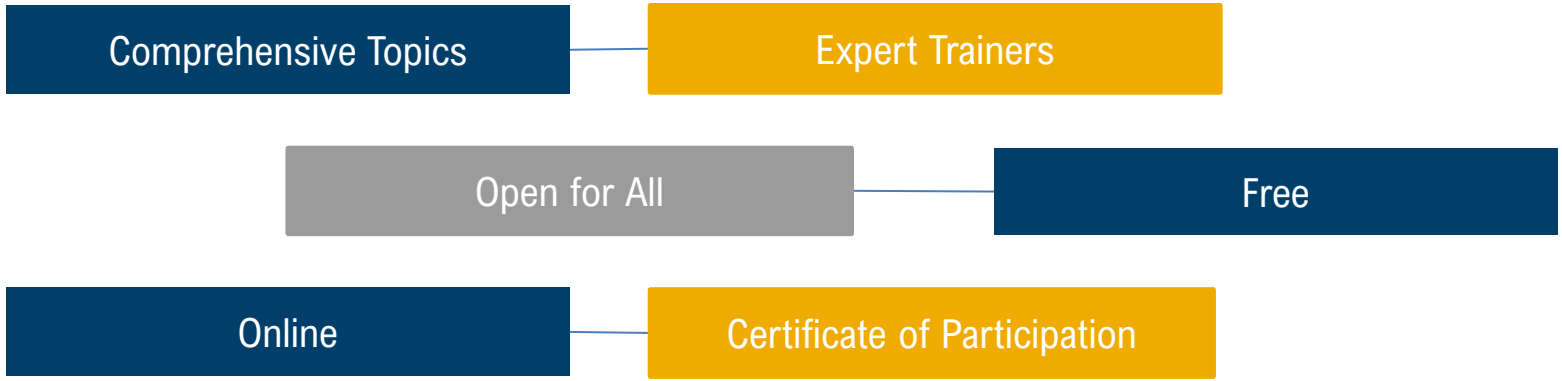
OBJECTIVES OF THE TRAINING SERIES

TOPICS COVERED IN THE TRAINING SERIES

* Hyperlink to event page with session recording and materials attached

ABOUT THE TRAINING SERIES

- Part of the Carbon Market Simulation Project, facilitated by WRI India and supported by MacArthur Foundation
- Conducted in partnership with Confederation of Indian Industry (CII)



NEED FOR ENERGY EFFICIENCY

Reduce energy consumption costs

High impact, cost effective way of emission reduction

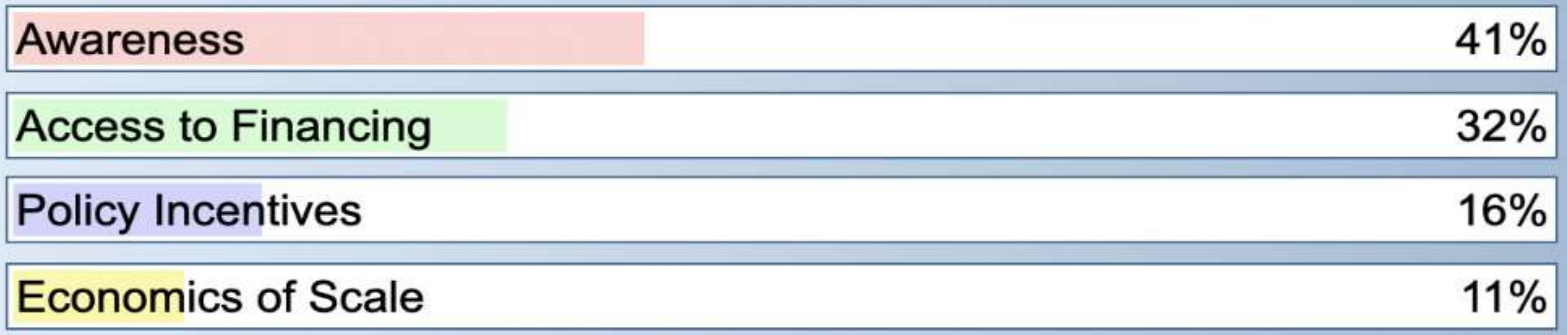
Prepare for current & future regulations

Easy access to financing options

Meet procurement requirements of corporate customers

I.1 According to you, the biggest challenge for implementing energy efficiency in MSMEs is the lack of?

Poll Results:



AGENDA

Introduction	Shubhangi Gupta, *WRI India*
Approach to Energy Efficiency in MSMEs	Akshay Koul, *CII-GBC*
Energy Efficiency in Value Chain: OEM Perspectives	Amol M. Magdum, *Godrej & Boyce Mfg. Co*
Opportunities from Energy Efficiency: MSME Perspectives	Suresh Manoharan, *Best Colour Solutions*
Energy Efficiency in MSMEs: Success Stories	Kajol, *Manager, WRI India*
Question & Answer Session I	
IoT/AI Solutions for Energy Efficiency	Vinit Kulkarni, *Greenovative Energy Solutions*
Energy Efficiency in Compressed Air Systems	Hidhay K., *Systel Group of Companies*
Energy Efficiency in Heating and Cooling Systems	Navin Kumar and Sandeep Koundinya, *Aspiration Energy and Energy & Emissions Lab*
Question & Answer Session II	
Closing Remarks	Atik Sheikh, *Counsellor, CII-GBC*

APPROACH TO ENERGY EFFICIENCY IN MSMEs

Akshay Koul, *Associate Counsellor, CII-GBC*

Confederation of Indian Industry

Energy efficiency enabling cost saving and reducing environment impacts

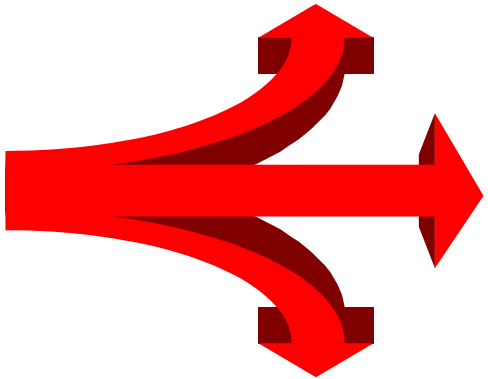
28 January, 2021

Background – Energy Efficiency (EE)

- Optimal utilization of energy without any trade-offs in smoother operations and safety
- Results in improved operation and reduced costs
- Mature concept in large industry and medium scale units
- Energy Efficiency is cross sectoral and continual

Approach towards Energy Efficiency

Three-pronged approach

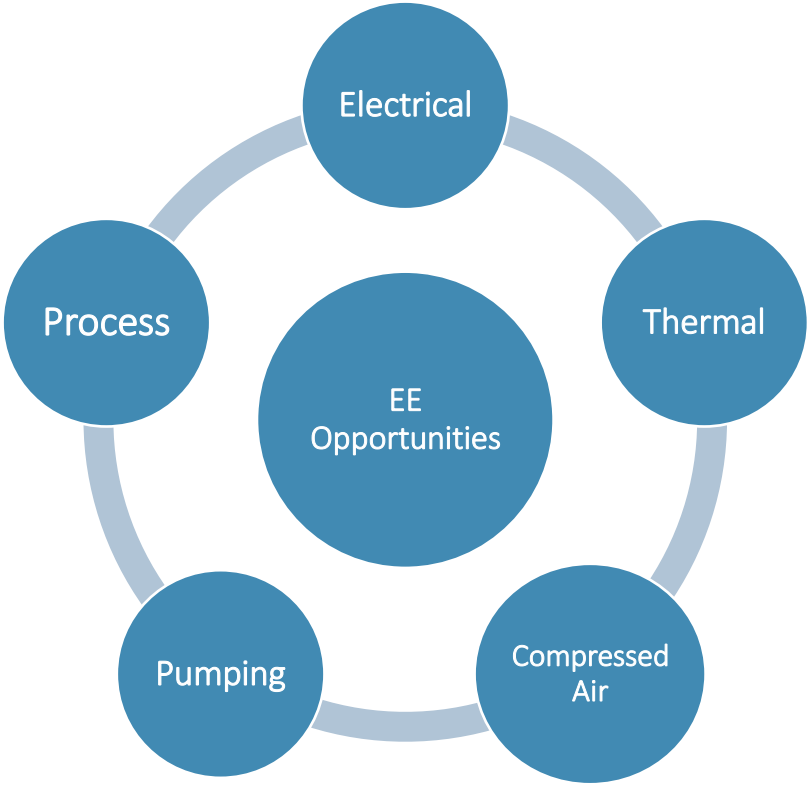


Capacity Utilization

Fine-tuning

Technology upgradation

EE – Opportunities



EE Measures - Electrical

❖Electrical Distribution

- Optimum transformers loading
- Power Factor Optimisation
  - Automatic Power Factor Controller
- Voltage Optimisation
- Energy Efficient Motor System
- Application of Variable Frequency Drive
- Energy Monitoring Systems

EE Measures – Pumps & Compressors

❖Pumps

- Optimum design (margin)
- Installation of Energy Efficient Pump sets
- Installation of VFD for capacity control
- Hydrophobic Coating

❖Compressed Air

- Arresting Leakages
- Optimum Generation Pressure
- Application of VFD (Loading/unloading)
- Use of Electrical instead of pneumatic equipment
- Waste Heat Recovery from compressors
- Sensor based auto drain valves
- Heat of Compression Dryer
- Installation of EE Compressor

EE Measures – Boiler & Steam Distribution

❖Boiler

- VFD for Feedwater Pump
- Automatic Blowdown and flash steam recovery
- Optimization of Combustion air
- WHR (Economizer/preheater)
- Multi-stage burner
- Optimum insulation
- EE Boiler (>80% eff.)

❖Steam Distribution

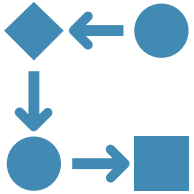
- Selection and maintenance of traps
- Installation of Micro turbine
- Condensate recovery
- Insulation to prevent heat loss
- Arresting Steam leakages
- Design of distribution line

Energy Efficiency – Key Drivers

Leveraging Digitalization for Energy Efficiency

Fostering Innovation – process & technology

Innovative Implementation Models



Leadership and core business strategy – Benchmarking; ISO 50001 EnMS

ISO 50001 – Energy Management System

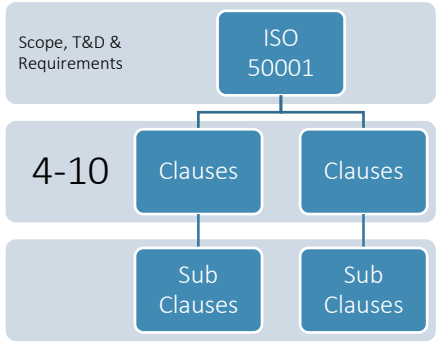
- A Guidance/Standard Document for
  - Structured approach to management of energy use
  - Voluntary global management system standard
  - Guide to Improve Energy Performance

- Intent
  - To enable organisation to establish system and processes necessary to improve energy performance, thus reduce GHG emissions, environment impacts and COSTS! (measurable improvement in performance)

ISO 50001
ENERGY MANAGEMENT

EnMS- Key Aspects

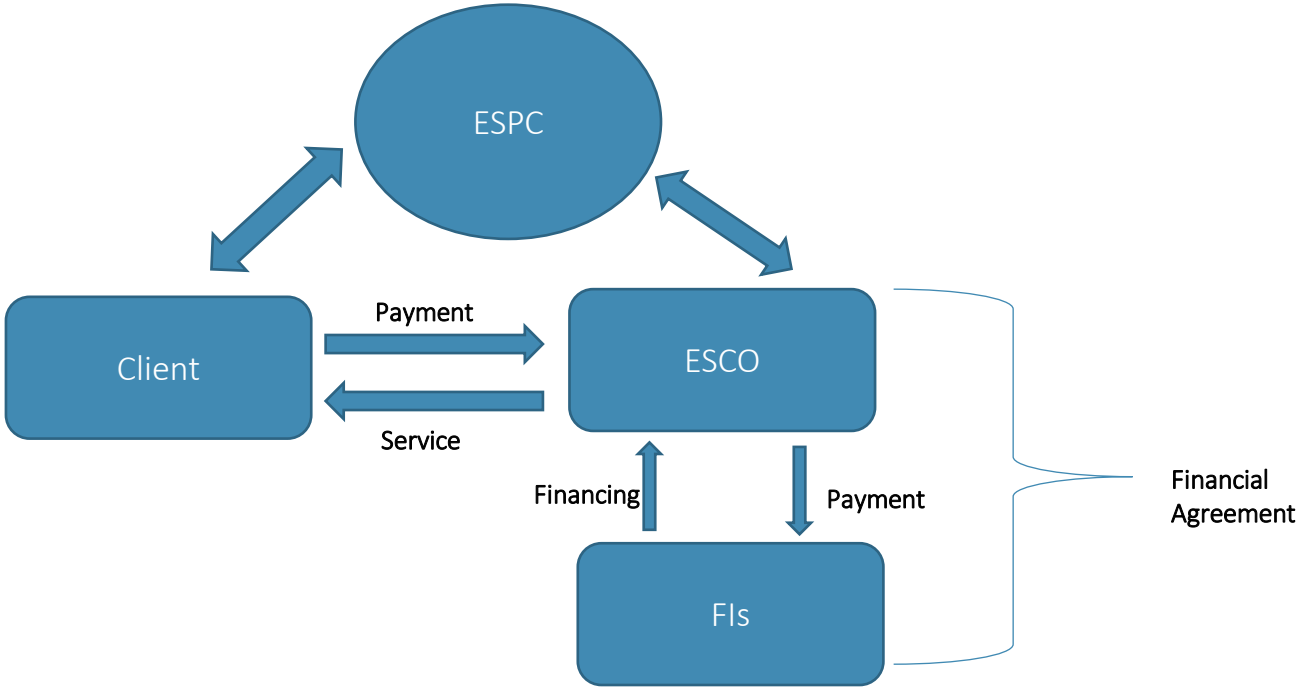
- Top Management Commitment
- Scope and Boundary of EnMS
- Energy Review
- Energy Action plan
- Energy Performance Indicators
- Documentation and reporting
- Design and procurement practices for energy-using equipment and systems
- Processes and personnel
- Training, capacity building and awareness
- Internal Review
- Management Review



Immediate outcome of EnMS

- Establishment of a baseline of energy use
- Conducting review of energy use
- Resource allocation for energy conservation and efficiency activities
- Awareness at levels
- Continual improvement in energy intensity
- Document savings for internal and potentially external use

ESCO – Implementation Model



Contact:
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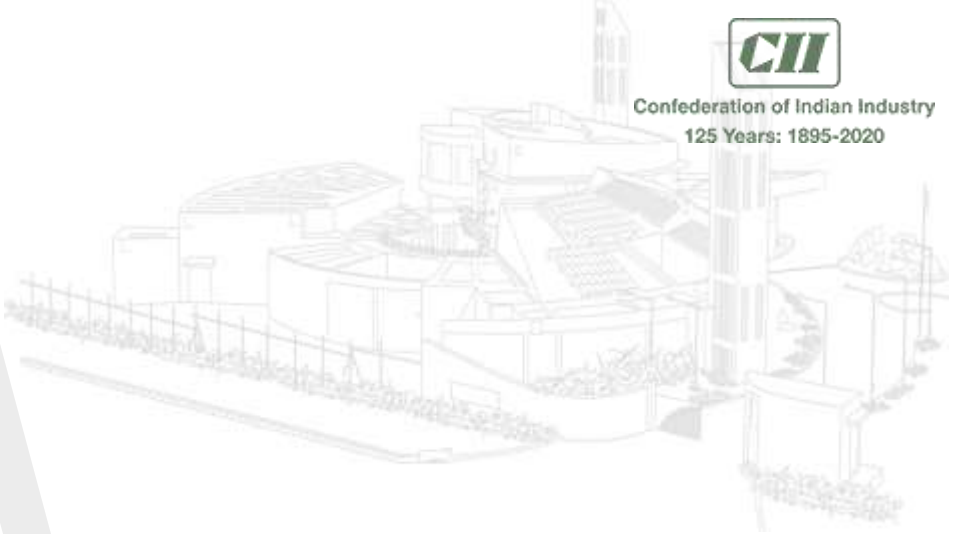
CII - Godrej Green Business Centre, India
akshay.koul@cii.in | +91 9550253830

Confederation of Indian Industry
125 Years: 1895-2020



THANK YOU!

For any queries related to energy efficiency log in @

CII Energy Efficiency Helpdesk

http://energy.greenbusinesscentre.com/sup/

For latest updates on energy efficiency please visit

http://energy.greenbusinesscentre.com/

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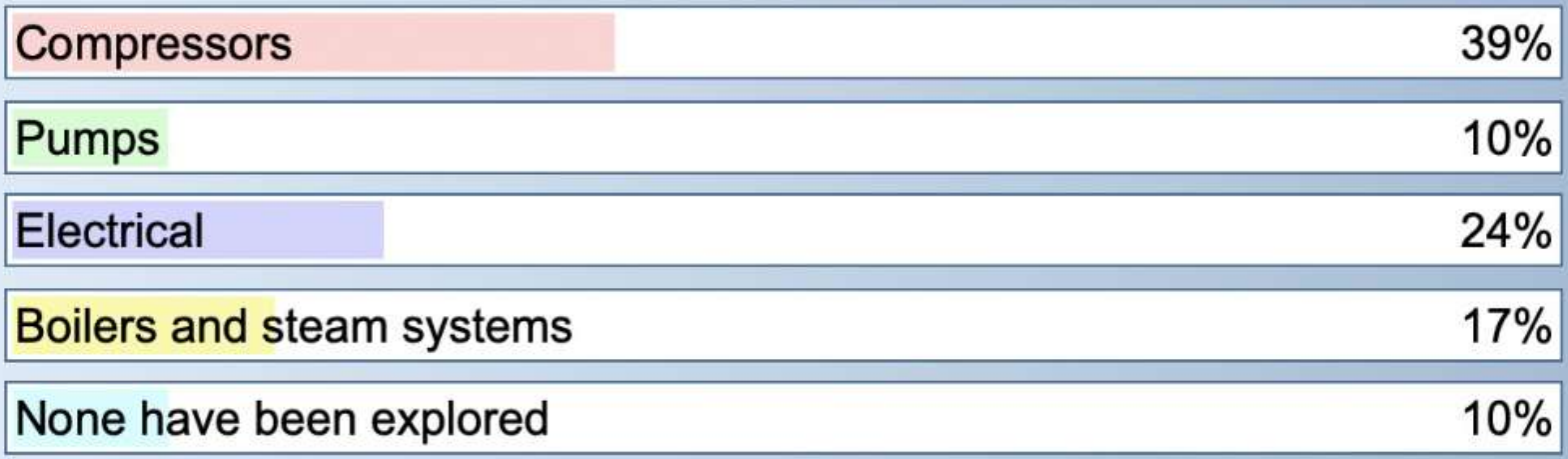
cii--godrej-gbc

E.1 While selecting a motor, which of the following is the most suitable evaluation criterion?

Poll Results (single answer required):

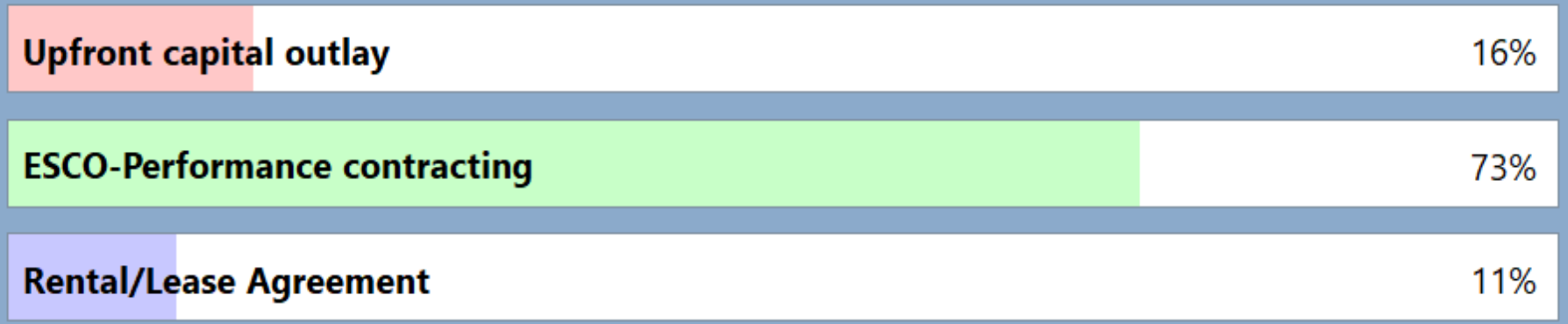
E.2 What are the unexplored utility applications for Energy Efficiency at your organisation?

Poll Results:



E.3 What Model of implementation will you prefer currently?

Poll Results (single answer required):



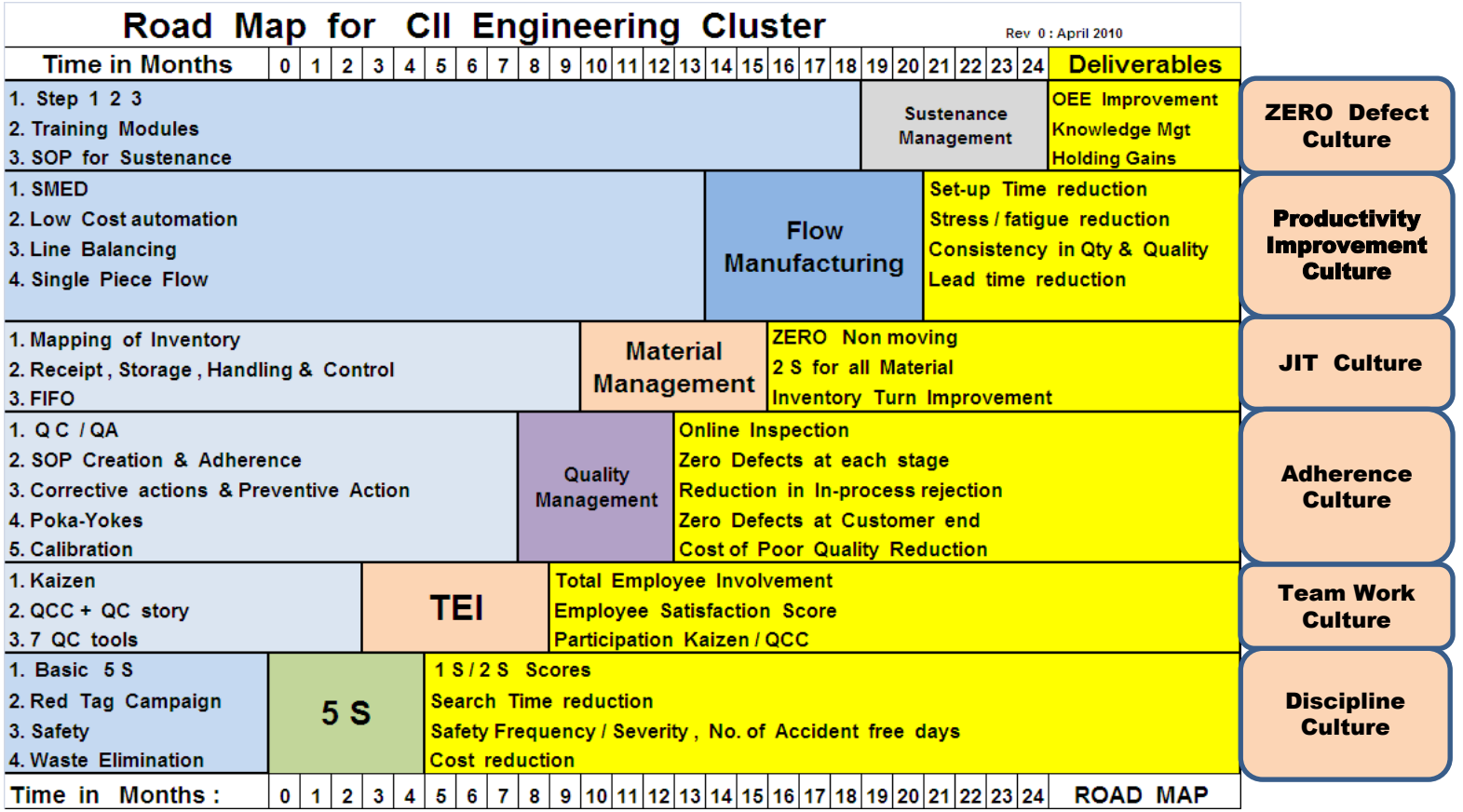
ENERGY EFFICIENCY IN VALUE CHAIN: OEM PERSPECTIVE

Amol M. Magdum, *Associate Chief Manager, Godrej & Boyce Mfg. Co.*

Energy Efficiency Improvement in Supply chain

Godrej | APPLIANCES

The Foundation



First Godrej & Boyce plant to join CII Hybrid Manufacturing Cluster.

Idea of Making Supplier Clusters

Inspired by the Lean Management principles of the Cluster, and the transformation of the Shirwal factory, an idea was mooted.

“Why not extend the learnings to our suppliers ?

- Mr. Jamshyd N Godrej
  Chainman & Managing Director, Godrej & Boyce Mfg Co Ltd.

Uniqueness & Guiding Principles

Uniqueness

No external consultants hired

A separate vertical created – Supplier Improvement Team

Implementation of Lean Manufacturing Techniques at SME plants

Aimed at up gradation of SMEs

Guiding Principle

Treat suppliers as extension of our own manufacturing facilities

Share & disseminate the learning's from Godrej Operational Excellence

Cluster philosophy

Coming Together….
Learning Together….
Practicing Together….
Progressing Together….

Organisation Structure

Godrej Team

Head Sourcing

Location Sourcing head
Responsible for driving the cluster

Plant manufacturing head to advice & guide cluster on technical issues

Supplier Improvement Team
Gives input & trainings during weekly visits along with domain experts

Co-owner
Works along with the SIT & review the progress of each supplier

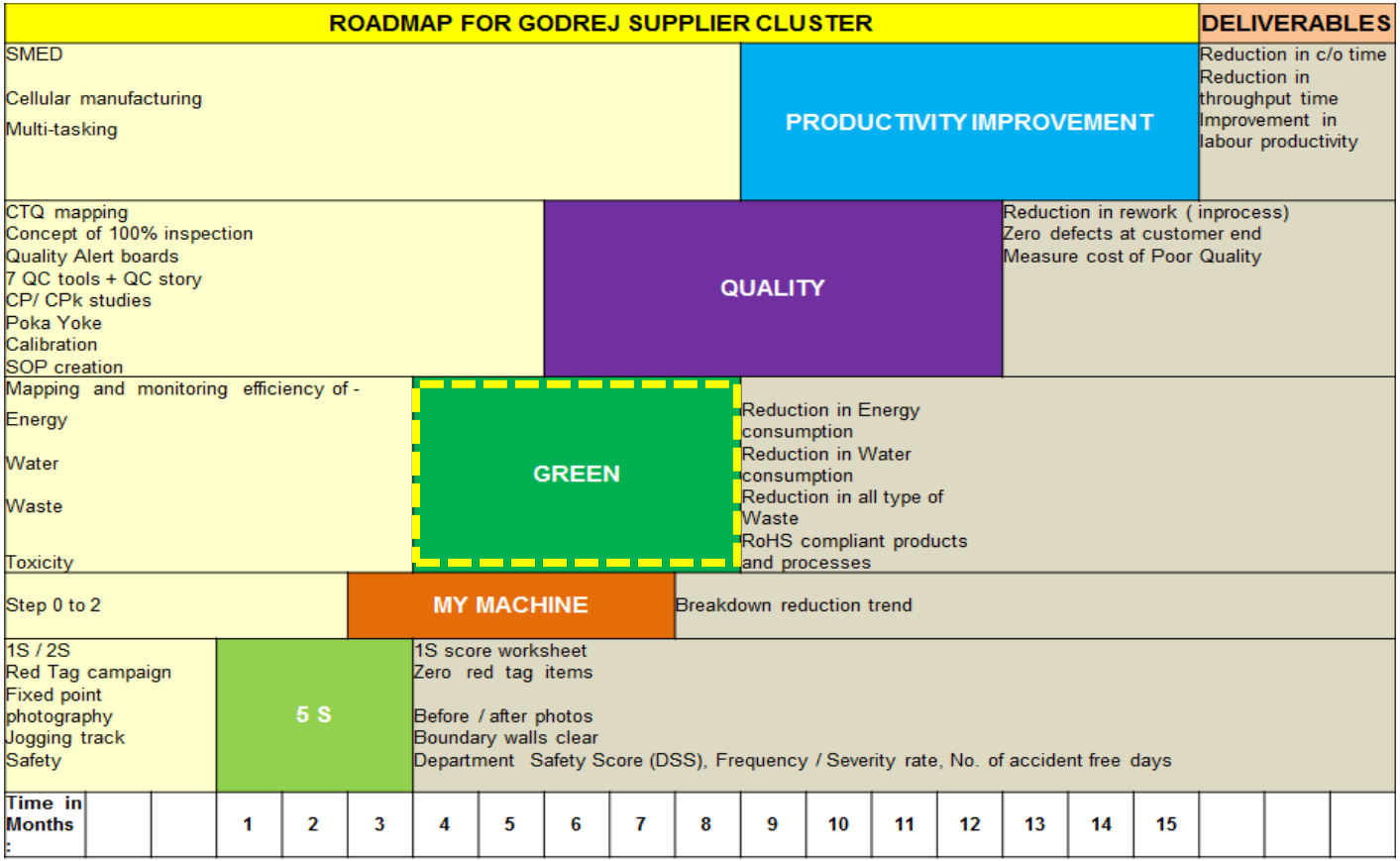
Supplier Team

Top Authority of Supplier
To drive cluster at supplier's plant

Top Authority of Supplier
To interact with Godrej Team for implementation of cluster leanings

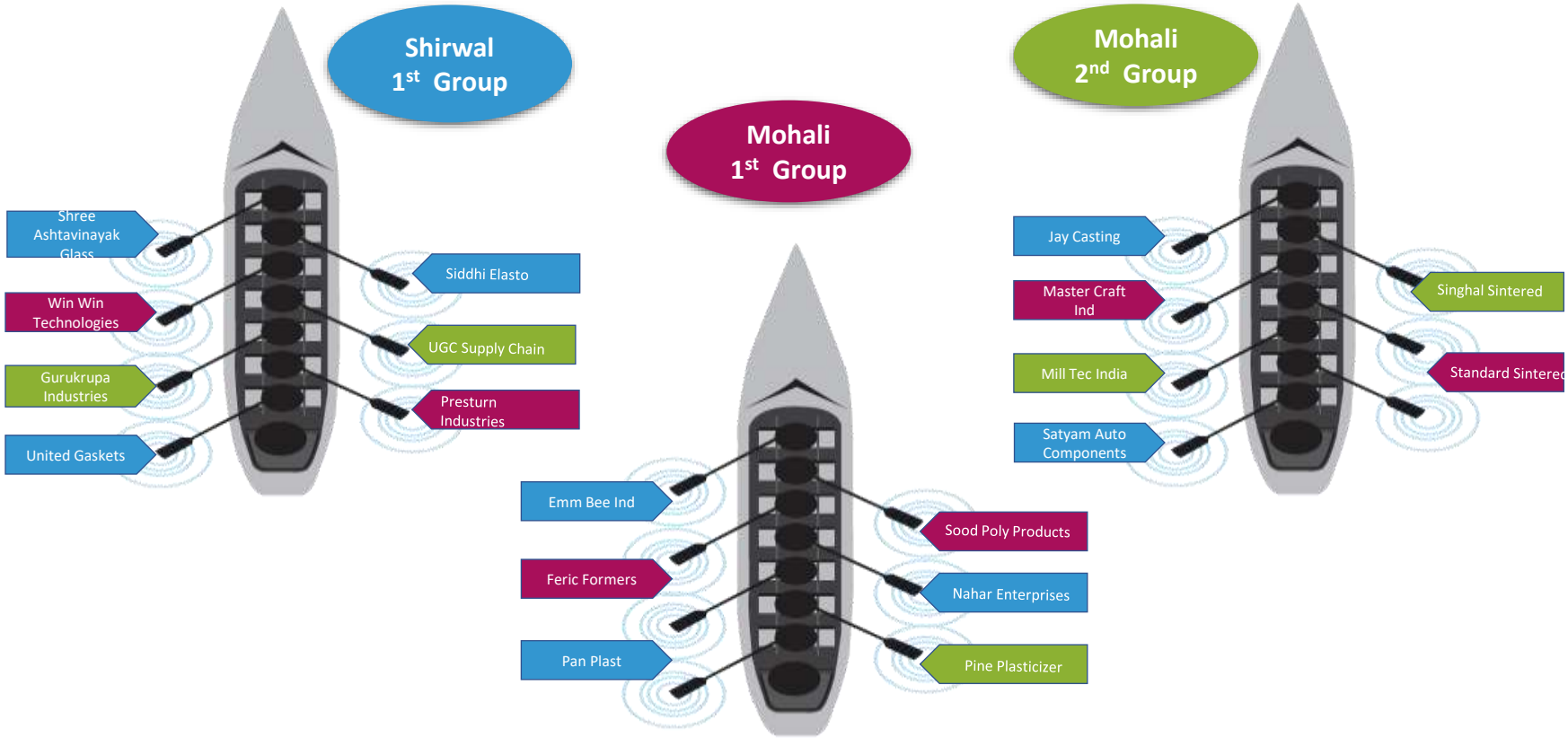
Well defined role & responsibilities of individuals

Supplier Cluster Roadmap



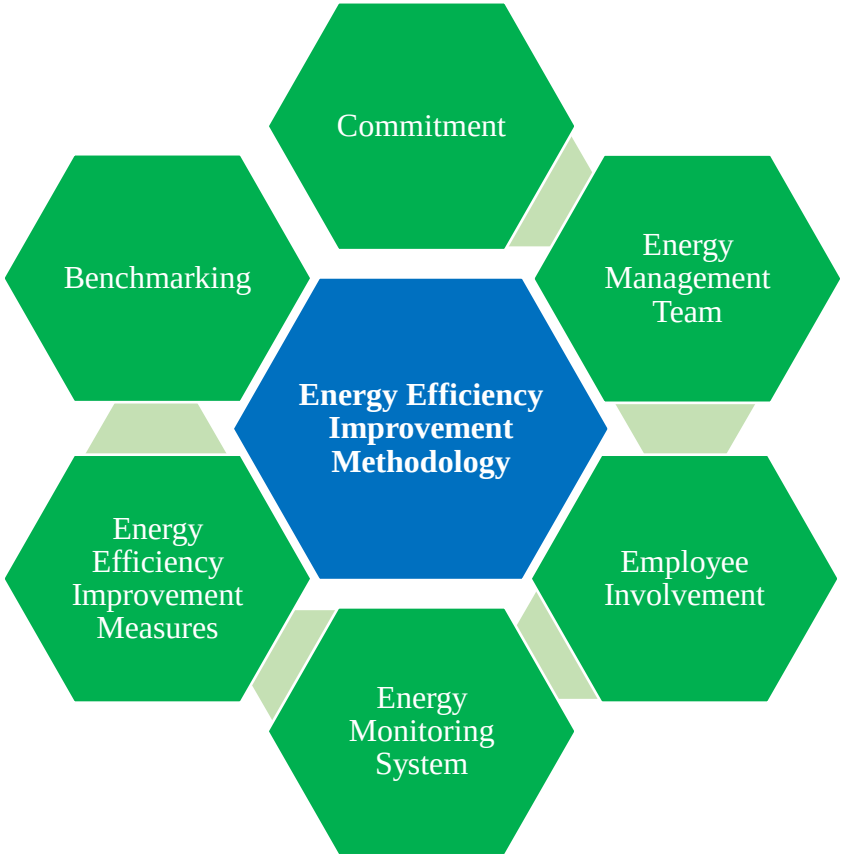
Balancing manufacturing growth and a clean environment.

First Cluster Roll Out



1st Cluster roll out – Jun'13

Methodology – Energy Efficiency Improvement



Commitment

- Vision
- Policy
- Target Setting
- Financial Allocation
- Review Mechanism

Green Vision

Green Vision

Environment friendly products & processes	**RoHS compliant products & processes**	Ensure 100% RoHS Compliance in future
Energy Conservation	**40% Reduction in Energy consumption by 2023**	Use of energy efficient equipment and energy efficiency operational practices
Water Conservation	**Water positive by 2022**	20 Lakh Litre water harvesting beyond the fence in FY 21-22 in collaboration with PAANI FOUNDATION
Resource Conservation	**Zero waste to land fill By 2022**	Replacement of raw material by recycled material / waste from 30% to 50% in FY 21-22
Systems	**ISO 9001:2015 (AY 2016) ISO 14001:2015 (AY 2019)**	ISO 45001:2018 (FY 21-22) GreenCo Platinum Plus (FY 21-22)

Vision communicates organization's value and its commitment to achieving its goals

Green Policy

DESHMUKH UDYOG PRIVATE LIMITED

GREEN POLICY

We at Deshmukh Udyog. Pvt. Ltd. are committed to conserve all key resources such as energy water, oil and other raw material by optimizing there use and continually improve our environmental performance by using renewable source of energy pollution preventing process and better waste disposal and practices recycling of material without compromising on high accelerated growth . To continue our efforts on this direction we are committed ourselves to :

- Comply environmental legislation and codes of practices.
- Follow 3R - Reduce, reuse, and recycle for all natural resource.
- Follow continual improvement principle with regards to air, from our premises and reduce it impacts on environment and local community.
- Purchases products and services that do the least damage to the environment.
- We shall create and enhance awareness on sound environmental practices amongst all our employees, suppliers, contractors and society.

This policy has been communicated and made assessable to everyone in our organisation and will be made available to customer suppliers, business associates and to other interested parties on request.

Rev No.: 00
Date : 26.06.2019

Uday Vaman Deshmukh
Director

Committed to conserve all key resources such as ENERGY, water and other raw materials by optimizing their use

Policy define the goals and provide guidance about how to achieve objectives

Target Setting

Green Vision Guidelines

Green Vision

Green Policy Guidelines

Green Policy

Internal Performance

External Benchmark

Benchmarking

Countermeasures against audit observations

Energy Audit

Setting goals is the first step in turning invisible into visible

Action Plan & Financial Allocation

	Present Consumption (FY 19-20)	Short Term (FY 20-21)	Mid Term (FY 21-22)	Long Term (FY 22-23)
SEC Target (kWh/MT)	**108**	**102 (5%)**	**97 (10%)**	**92 (15%)**

SN	Initiative	Year of Implementation	Benefit (kWh/year)	Investment (Rs. Lacs)
1	Use of energy efficient motors for all machines	2022	18700	2.5
2	Installation of energy monitoring software for monitoring specific energy consumption for all electrical equipments of machines	2021	---	1.5
3	Purchase bolt for new auto 4 stage bolt former for reduce the energy	2023	12000	22
4	Up-gradation of Hardening Oven	2021	2400	0.60
5	Upgrade the plating plant	2022	2400	5.5
6	Installation of Screw compressor AC-CD 7.5	2022	1500	5.5

Resourcing waiting for ideas, not ideas waiting for resources

Review Mechanism

MRM – Supplier End

- Review of section-wise energy consumption
- Analysis of daily energy consumption for high energy consumption machines
- Discuss action plan on deviations
- Ideation for new energy conservation projects
- Review status of work in progress projects

MRM – Supplier Cluster Program


Presentation by Cluster Suppliers


GEMBA Visit


Classroom Training

Agenda
Welcome Remarks by Host Company
Performance review of Host Company
Gemba visit
Observation feedback using photographs
Performance review of other participating cluster members
Finalisation of next MRM, venue and date.
Training on next module of Cluster Roadmap
Closing Remarks by GAD Management

Performance monitoring by Top Management

Total Employee Involvement

Employee Involvement Strategy

Communication

- Training Program
- Tool Box Meeting
- Contact Program

Event Celebration

- Energy Conservation Week
- Safety Week
- Environment Day

Employee Participation

- Suggestion Scheme
- Quality Circles
- Kaizen
- Small Group Activity

Reward & Recognition

- Best Kaizen Award
- Best Energy Captain
- Energy Efficient Section

TEI helps builds a work culture of collaborative workforce for better growth & success

Training & Capacity Building

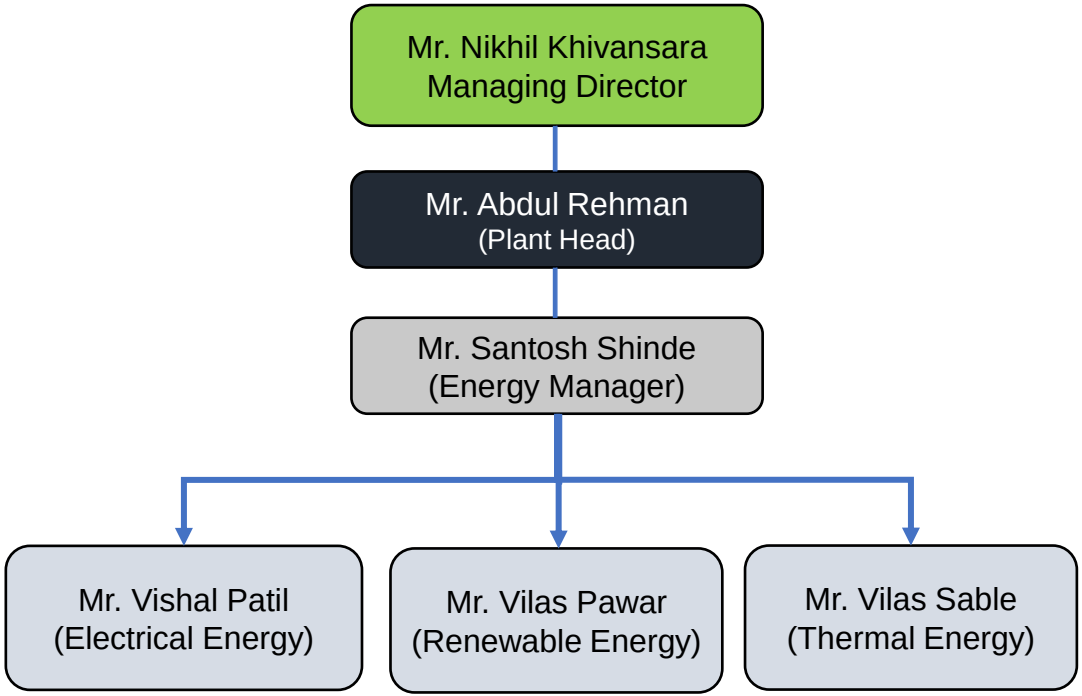
Strategy

Training & Capacity Building

Initiative	Outcome
Godrej Supplier Cluster Program	Implementation of concepts of Lean & Green Manufacturing
CII - GreenCo Kick Off	Training on SME GreenCo Rating System & all 8 parameters of GreenCo by CII
Supplier Handholding by Godrej	Training, Visits, Reviews & Preparation
Attending Conferences & Summits	Green Processes & Technologies, New ideas on Resource Conservation
Visit to GreenCo Certified Suppliers	Infrastructure, GreenCo Implementation Team, Review Mechanism & Green Initiatives

Training & Capacity Building

Energy Management Team



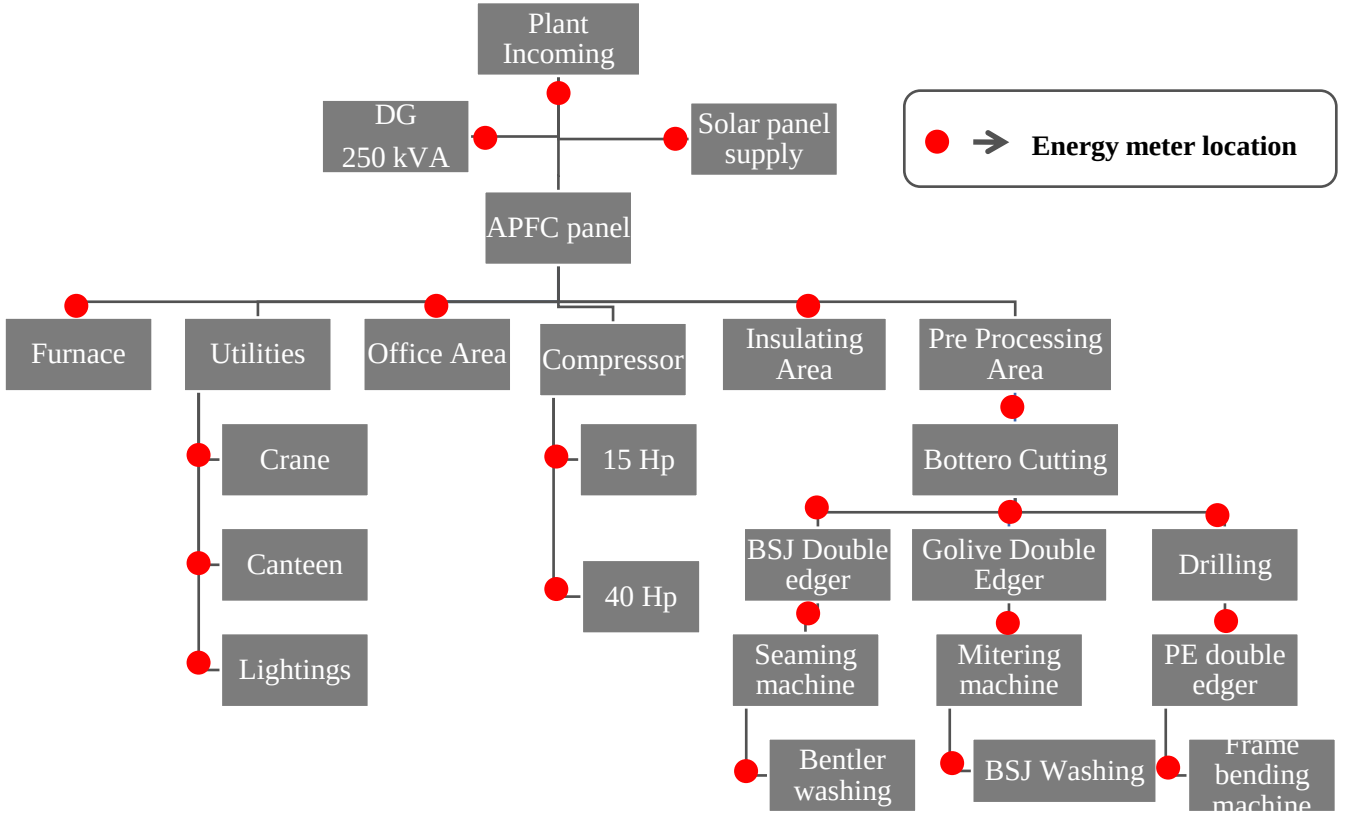
Role & Responsibilities

- **Director & Plant Head –**
  - ✓ Review & approve energy conservation projects.
  - ✓ Create different platforms for spreading awareness on energy conservation amongst all employees.
- **Energy Manager –**
  - ✓ Data analysis.
  - ✓ Identification, feasibility study, payback calculation of energy conservation projects.
  - ✓ Getting approval for new projects from the management.
- **Energy Management Cell –**
  - ✓ Creating energy conservation awareness in the company.
  - ✓ Sharing of ideas between various departments.
  - ✓ Implementation of energy saving projects.

Energy Monitoring System

- Energy Metering
- Daily Variance Analysis
- Corrective Action on Deviation

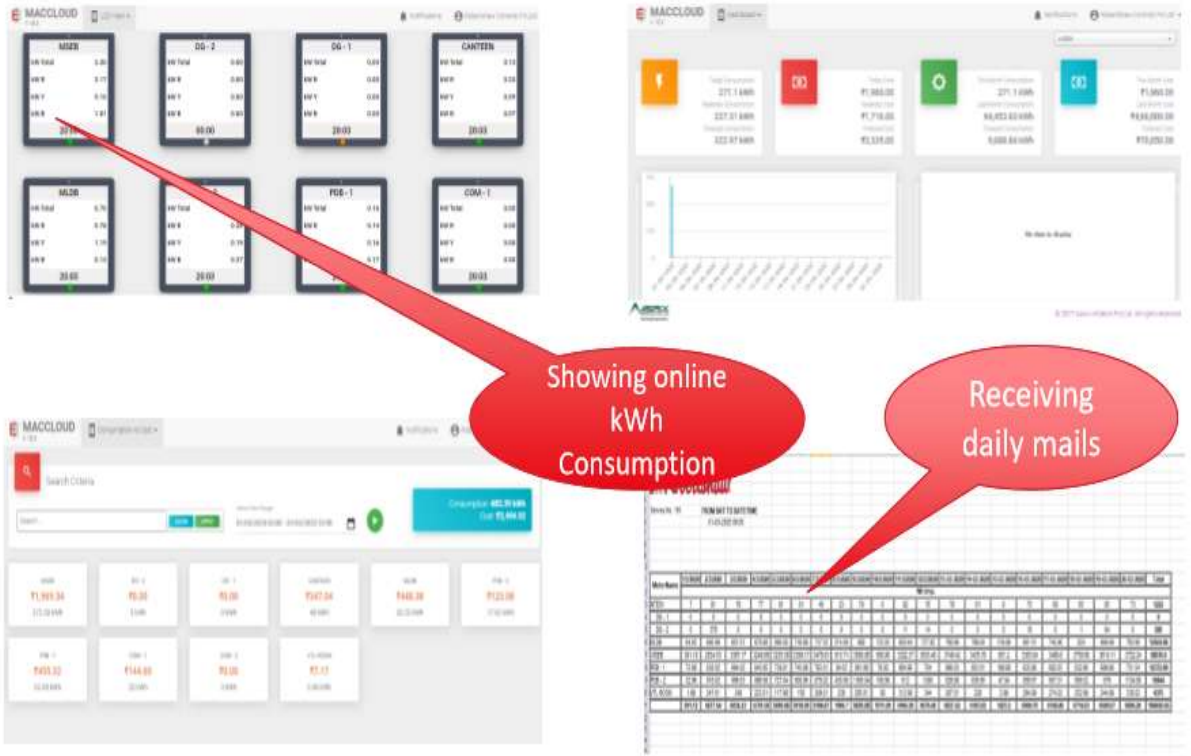
Energy Metering



>80% energy monitoring through energy meters

Online Energy Monitoring

Real Time Energy Monitoring Software

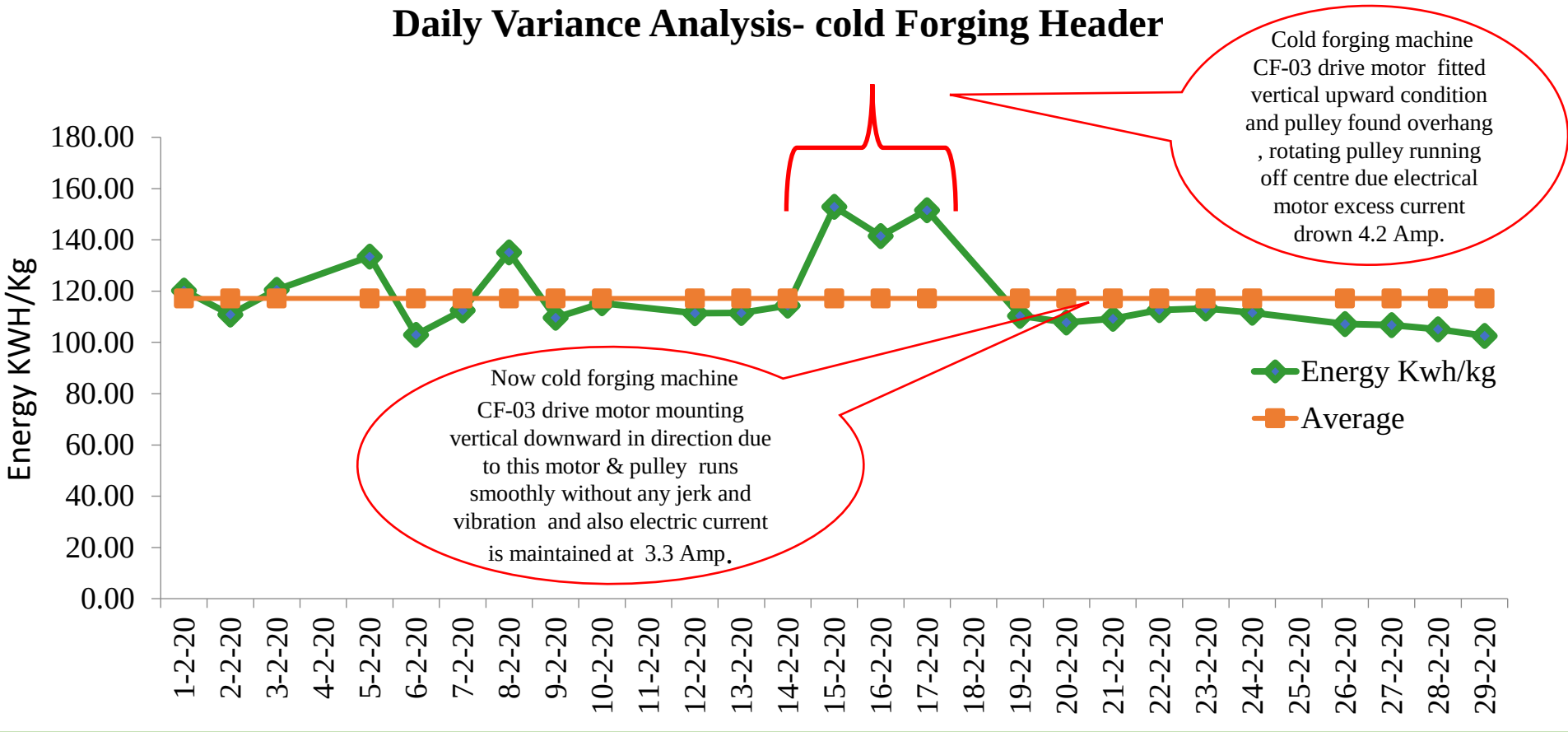


Provides data

- ✓ kWh
- ✓ Voltage
- ✓ Current
- ✓ Consumption
- ✓ Department wise Consumption
- ✓ Machine wise Consumption
- ✓ Daily reports to all energy members

Cloud based system with storage space up to 3 years

Daily Variance Analysis



Corrective Action on Deviation

Analysis of Deviation

Problem Status	**High energy consumption in Cold forging Header machine CF-03**
Why 1	High energy consumption in 16th to 18th Feb-20
Why 2	Machine motor was drawing excess current (Required 3 to 3.2 amp & actual 4,2 amp)
Why 3	Pulley running off centre & overhang
Why 4	Motor bearing wear out due to shaft bend
Route cause	Motor bearing wear out due to shaft bend

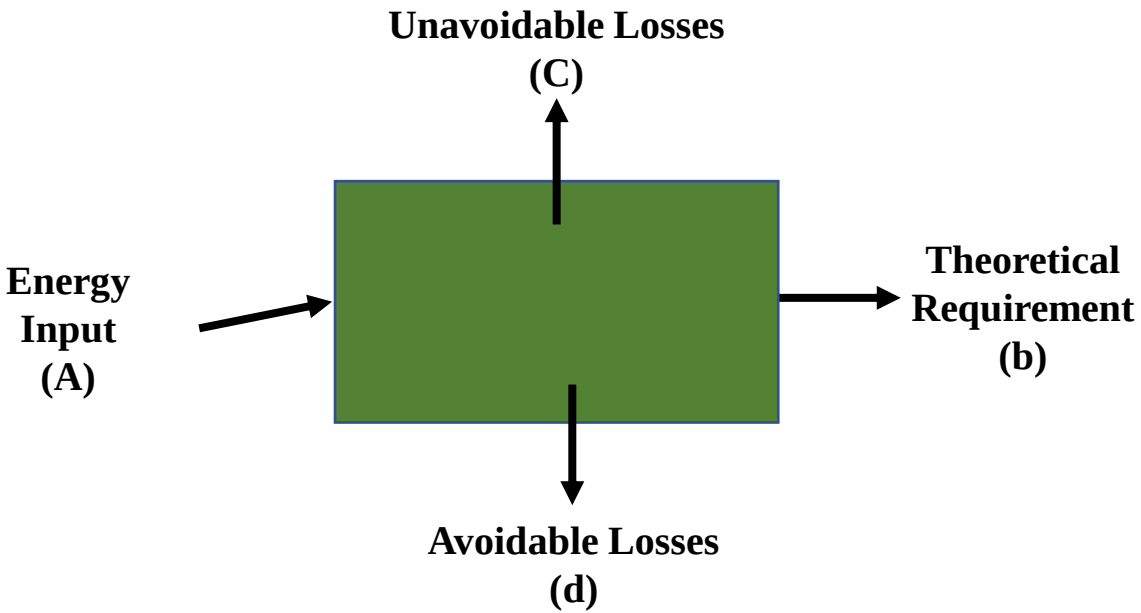
Corrective Action on Deviation

Motor bearing damaged due to shaft & bearing misalignment. Pulley running off Centre due to overhang

- Shaft & bearing alignment corrected & motor bearing changed
- Frequency set for shaft alignment (Once in year)
- Drive motor & pulley location charged to avoid overhang

Energy Efficiency Improvement Measures

Macro Level Methodology



$$A = b + c + d$$

Focus should be on

- **Quantify the losses**
- **To concentrate on avoidable losses**
- **Identify ways and means for reduction**
- **Implementation**

Energy Efficiency Improvement Measures

Lighting & Electrical Systems

- Maintaining power factor close to unity or unity
- Measuring efficiencies of motor and replacement of old inefficient motors
- Maximum usage of daylight (transparent sheets / sky lights)
- Lux mapping across the plant level and provide exact lighting as per requirement
- Lowering the heights of luminaires wherever possible

Energy Efficiency Improvement Measures

Compressed Air

- Monitoring of air leakages and taking corrective actions
- Segregation of pressure lines
- Aluminium piping for compressed air network
- Installation of VFDs
- Use of transvector nozzles

❖ Saving potential 50%

Energy Efficiency Improvement Measures

Pumps, Fans, Blowers

- Arresting leakages in water pipe lines and air ducts
- Monitoring of efficiencies
- Installation of VFDs
- Use of coatings to reduce friction in pumps and increase efficiency

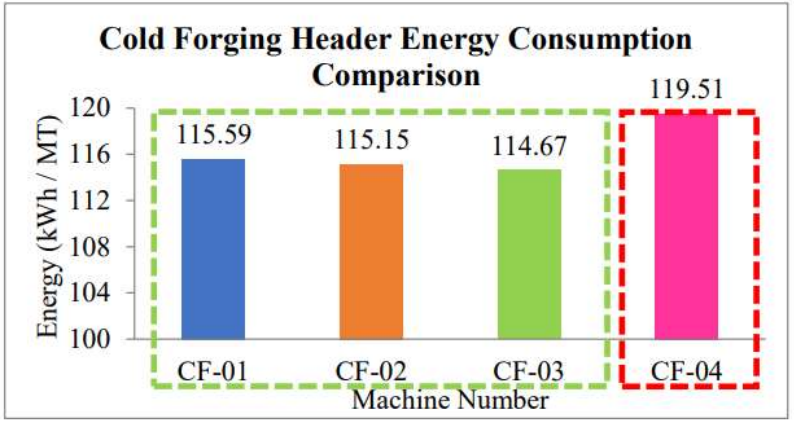
Energy Efficiency Improvement Measures

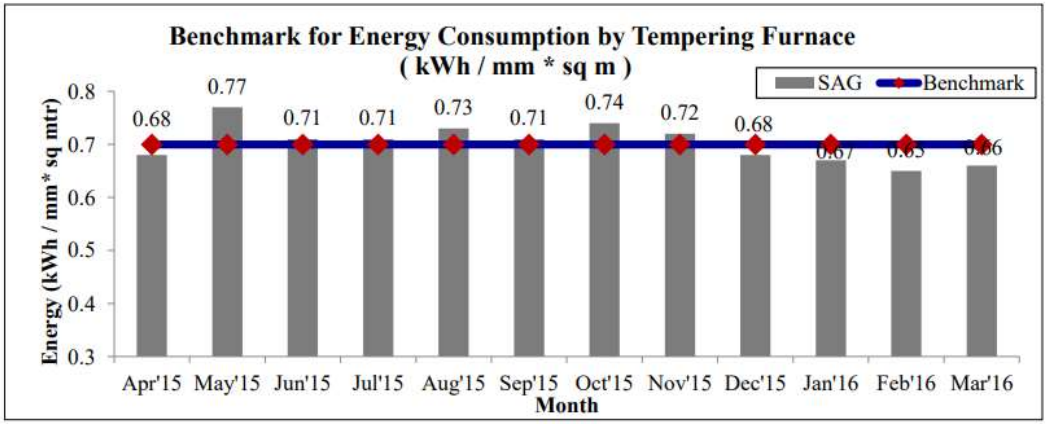
Boiler, Furnaces

- Monitor efficiencies
- Monitoring condition of insulations periodically and take corrective actions accordingly
- Use of insulation paints wherever applicable
- Replacement of old inefficient boiler with latest energy efficient boiler

Benchmarking

- Source of information
- Inter plant comparison within the Group
  - Process Benchmarking
  - Machine Benchmarking
- Comparison with publicly available data
- Sustainability Reports
- Awards Presentations
- Data from Sectoral Associations





** Source – Saint Gobain India Pvt. Ltd

GreenCo for SME Supply Partners

SME GreenCo Rollout – GAD, Shirwal

GreenCo for SMEs – Roll out at GAD Shirwal on 16th Feb'16

SN	Supplier Name	GreenCo Rating
1	Shree Ashtavinayak Glass Pvt Ltd	Platinum
2	Khutale Engineering Pvt Ltd	Platinum
3	Ajay Poly Pvt Ltd	Gold

Approach

Registering suppliers for GreenCo Certification

↓

Supplier Training on GreenCo Rating System by CII

↓

Supplier Training on various module of GreenCo by Godrej

↓

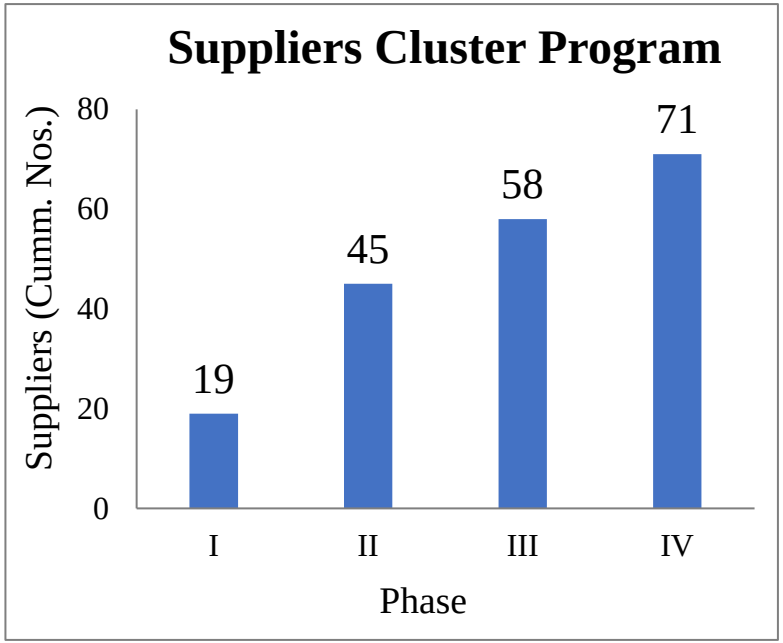
Supplier Handholding for GreenCo certification preparation by CII & Godrej

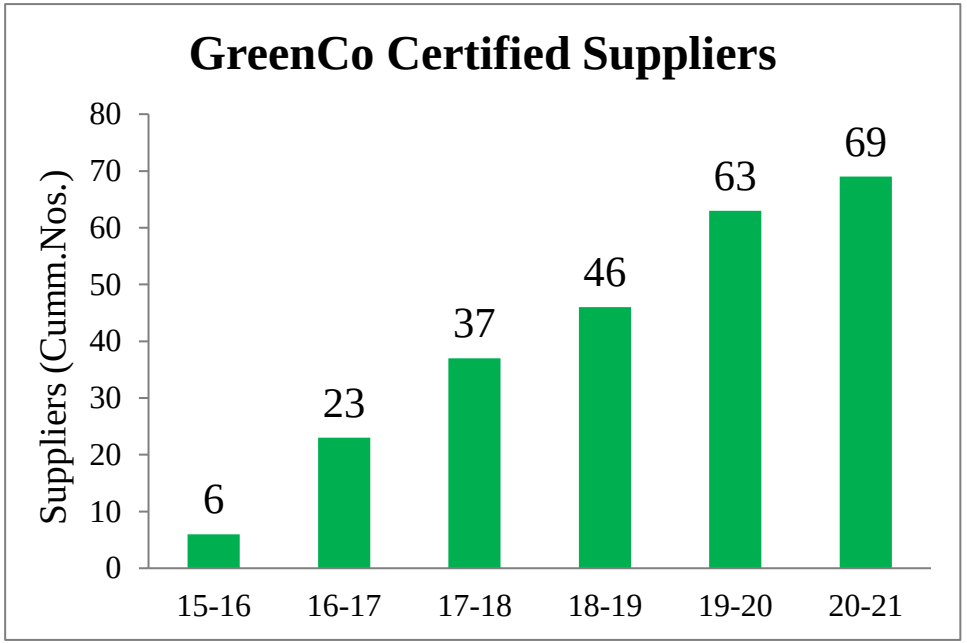
↓

Supplier Site Assessment by CII

1st in India to launch GreenCo for SME supply partners

Scaling Up





Maximum number of GreenCo certified supplier partners for any OEM in India

Benefits

Supplier

29% reduction in energy consumption

37% reduction in fresh water consumption

31% reduction in waste

32% reduction in GHG emissions

Godrej Appliances

84% of local buy from GreenCo certified suppliers

100% RoHS complied outsourced parts / products

47% reduction in incoming packaging waste

17% reduction in GHG emissions from transportation

29% reduction in energy consumption in value chain

Thank You….

OPPORTUNITIES FROM ENERGY EFFICICNEY: MSME PERSPECTIVE

Suresh Manoharan, *Executive Director, Best Colour Solutions*

Best Colour Solutions India Pvt Ltd

- Textile dye house located in SIPCOT, Perundurai, Erode District, Tamil Nadu.
- Dyeing capacity: 6,500 kgs per day
- Operation since: Jan 2008
- Annual Turnover: Rs.25 Crore
- Category: MSME - Small

Fashion Industry

Without textile dyeing, there is no value addition in the textile supply chain.

Apprehensions about Textile Dyeing

- High water consumption, resulting in huge effluent generation.
- High energy consumption.

Zero Liquid Discharge Scheme (ZLDS)

- **Under ZLDS, there is no discharge of (liquid) effluent, neither outside the factory nor inside the factory.**

- **Entire effluent generated is treated, recovered and reused.**

Only 10% of fresh water is required for top-up.

Energy Consumption in Production

- Dyeing requires heating fresh water to high temperatures (60° c to 120° c)

- At the same time, dyeing effluents are drained at hot temperatures (60° c to 80° c)

Hence, planned on implementing:

"Heat Recovery System"

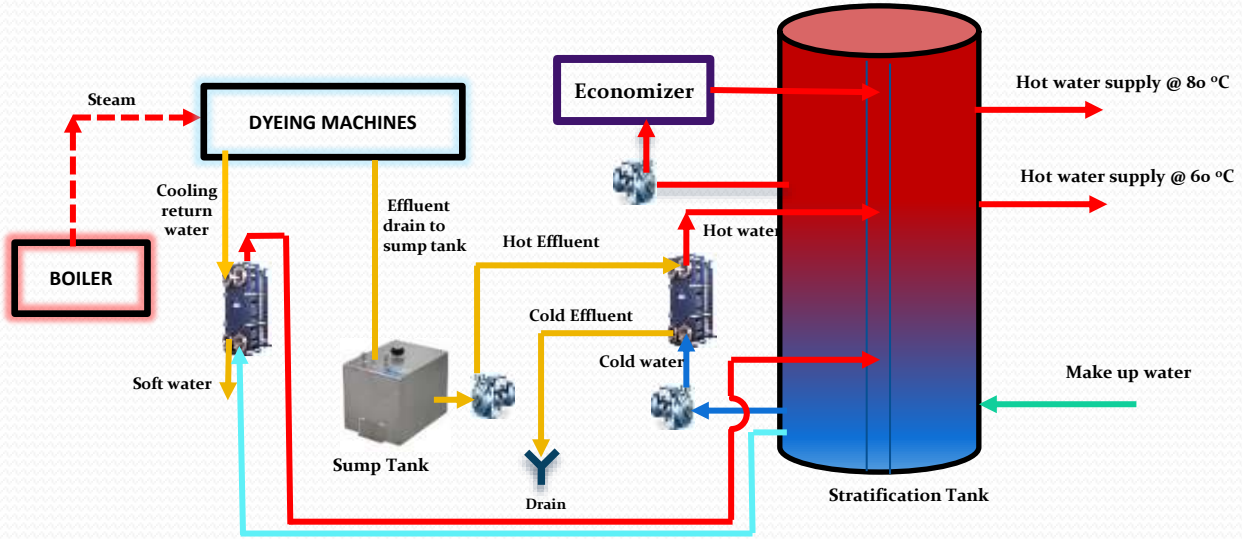
Solution Overview

Integrated heating solution for dyeing process waste heat recovery from different sources:

- **Energy recovery from wastewater in dyeing process**
- **Energy recovery from cooling process in dyeing machines**
- **Energy recovery from boiler flue gas**

Vendor: Bosch Limited

Solution Overview



Vendor: Bosch Limited

Energy Efficiency Solution

Vendor: Bosch Limited

Cost Savings Calculation

Particulars	13-07-2020 to 19-07-2020	20-07-2020 to 26-07-2020	27-07-2020 to 02-08-2020	03-08-2020 to 09-08-2020
	With Bosch	Without Bosch	With Bosch	Without Bosch
Total Steam Production (3TPH+2TPH) (Kg)	3,31,582	3,15,035	3,20,979	3,45,320
Total Wood Consumed (3TPH+2TPH) (Kg)	1,05,289	1,00,469	1,01,987	1,11,092
Specific fuel Cosumption (Kg)	3.1493	3.14	3.1473	3.11
Steam Consumed for Processing (Kg)	1,22,775	1,56,415	1,20,721	1,51,227
Theoritical Wood Consumed for Processing (Kg)	38,985	49,883	38,358	48,651
Normalized Fabric Processed Quantity (Kg)	37,145	36,740	37,466	34,929
Wood Consumed per Kg of fabric processed (Kg)	1.05	1.36	1.02	1.39
Wood Saving %	**22.70%**		**26.50%**	

Economics

Avg wood consumption for processing = 7,000 kgs

Fuel savings = 24%

Wood savings per day = 1,680 kgs

= 1,680 * Rs.4.90

= Rs. 8,200

Annual Savings = 290 days * Rs. 8,200

= Rs. 24 Lakhs

Investment = Rs. 85 Lakhs

Return of Investment : 3.5 years

Benefits of Implementation

- ***Reduced steam consumption resulting in 24% fuel savings.***

- **Lower temperature discharge of effluent to ETP reduces the effluent treatment cost.**

- **Hot water direct consumption in the machines results in reduction of steam peak load from the boiler. The elimination of pressure fluctuation improves the boiler performance.**

- **One of two existing boiler moved to standby mode.**

CII GreenCo Certification

In the process of obtaining CII GreenCo Certification through CII - Sohrabji Godrej Green Business Centre, Hyderabad.

Shortcomings Observed in MSMEs

Not investing in utility monitoring equipment.

Steam Flow Meters:

- 3 TPH Boiler
- 2 TPH Boiler
- Process House
- ETP – Multiple Effect Evaporator (MEE)
- ETP – Agitated Thin Film Dryer (ATFD)

Weighing Scales:

- 3 TPH Boiler Fuel Feeding
- 2 TPH Boiler Fuel Feeding

Energy Meters:

- 3 TPH Boiler
- 2 TPH Boiler
- BOSCH Heat Recovery System

Shortcomings Observed in MSMEs

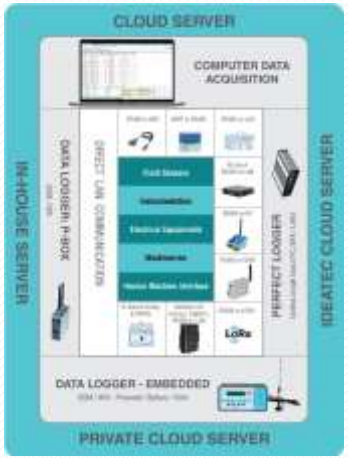
Utility Report for Boiler Till 16/2/2018 (For the Month of -Feb)

Item	Description	Avg	Total	1	2	3	4	5	6	7
STEAM BOILER (2 TPH)	Running Hrs	23:53:00	382:02:00	24:00:00	23:59:00	23:58:00	24:00:00	23:59:00	23:59:00	23:51:00
	FireWood Consumption	8185.875	130974.000	9676.000	8[illegible]3.000	8392.000	8653.000	8921.000	8959.000	8680.000
	Electricity Unit	81.379	1302.057	86.044	[illegible]8.927	86.847	86.779	77.195	82.107	84.929
	Steam Generated	28991.000	463856.000	32258.000	307[illegible]9.000	28867[illegible]00	29622.000	[illegible]0060.000	31036.000	[illegible]8658.000
	FireWood Cons/Hour	342.951	342.95	403.167	[illegible]9.965	350.153	360.542	371.967	373.551	363.941
	Electricity Units/Hour	3.408	3.41	3.585	3.708	3[illegible]24	3.616	3.219	3.423	3.561
	Steam Generated/Hour	1214.177	1214.18	1344.083	12[illegible]2.516	1204[illegible]65	1234.250	1253.370	1294.065	1201.593
	FireWood Cost	28778.733	460459.720	30963.200	283[illegible]3.600	26854[illegible]00	27689.600	[illegible]8547.200	28668.800	[illegible]7776.000
	Electricity Cost	813.790	13020.570	860.440	[illegible]9.270	868[illegible]70	867.790	771.950	821.070	849.290
	Chemical Cost	285.598	4569.566	312.320	[illegible]4.089	304[illegible]89	304.089	304.089	304.089	304.089
	Maintanance Cost									
	Total Cost	29878.12	478049.86	32135.96	29[illegible]86.96	2802[illegible].96	28861.48	29623.24	29793.96	28929.38
	Cost/Unit Of Steam	**1.03**	**1.03**	**1.00**	**0.96**	**0[illegible]97**	**0.97**	**0.99**	**0.96**	**1.01**

Vendor: Ideatec Softwares India Pvt Ltd

Shortcomings Observed in MSMEs

Not investing in IoT based real time data acquisitions and analytics.



Vendor: Ideatec Softwares India Pvt Ltd

Thanking You

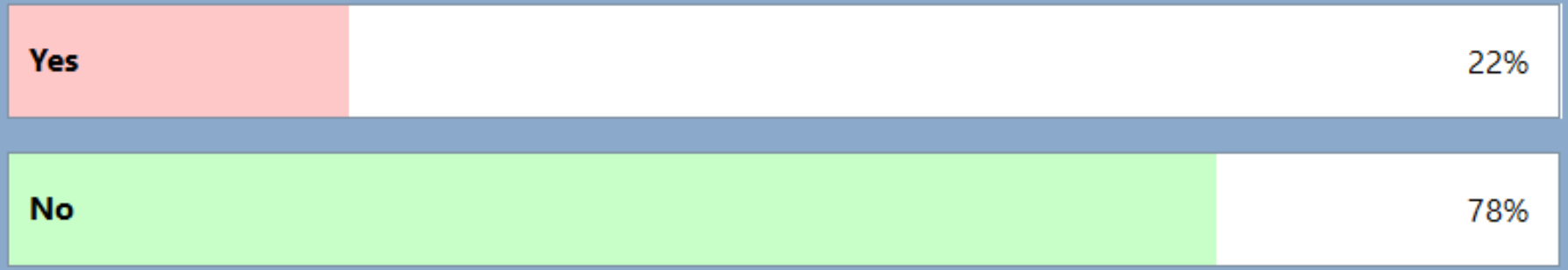
Mr. Suresh Manoharan
Executive Director
Best Colour Solutions India Pvt Ltd
www.linkedin.com/in/suresh-manoharan

ENERGY EFFICIENCY IN MSMEs: SUCCESS STORIES

Kajol, *Manager, Energy Group, WRI India*

E.4 Have you been a part of any aggregation model or heard about this in the past?

Poll Results (single answer required):



WRI INDIA

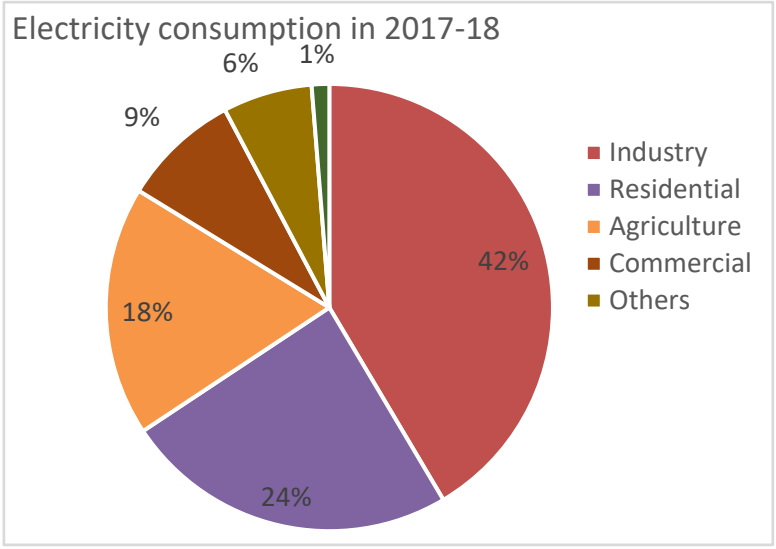
DEMAND AGGREGATION FOR CLEAN ENERGY IN MSME CLUSTERS

Lessons and Insights from Naroda and Aurangabad

WRI INDIA, JAN 29, 2020, INDIA INTERNATIONAL CENTER, DELHI

WHY IS DEMAND AGGREGATION IMPORTANT?

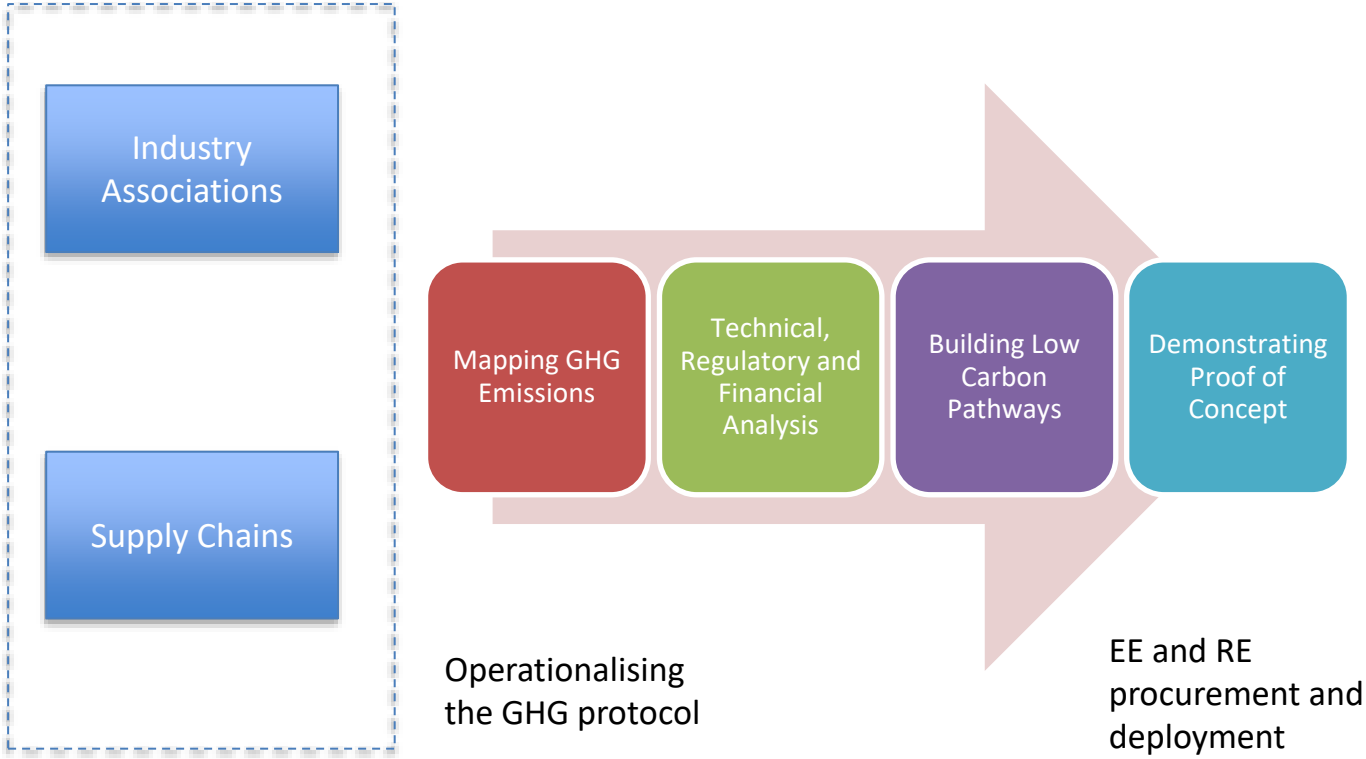
- 63.3 million MSMEs. Of which 31% are manufacturing units; account for 25% of the industrial sector's energy consumption.
- Large companies have more or less figured out avenues for clean energy interventions
  - Workable avenues for MSMEs
- Key argument for aggregation – **economies of scale**



ANCHOR PARTNERS AND LOCAL PARTNERS

	Naroda	Aurangabad	Supply Chain
Anchor Partner	Naroda Industries Association (NIA)	Marathwada Association of Small Scale Industries and Agriculture (MASSIA)	H&M
Local Partner	Gujarat Cleaner Production Center (GCPC)	Eco Energy Management System (EEMS)	

METHODOLOGY



Operationalising the GHG protocol

EE and RE procurement and deployment within aggregators

SNAPSHOT OF FINDINGS

NAME	NARODA INDUSTRIES ASSOCIATION	MARATHWADA ASSOCIATION OF SMALL-SCALE INDUSTRIES	SUPPLY CHAIN UNITS OF H&M
No. of units studied	70 units	75 units	31 units
Type	Chemical Cluster	Automobile cluster	Garment manufactures
Primary Fuel	Piped Natural Gas (PNG) and wood	Grid based electricity	Grid and diesel-based electricity
Secondary Fuel	Grid based electricity	LPG and furnace oil.	Coal and oil
Baseline GHG emission (tonnes of CO_2 eq.)	56592.5	15150.13	421985
Emission potential	Scope 1 emission was higher than scope 2 emission	Scope 2 emission was higher than Scope 1 emission	Scope 1 emission was higher than Scope 2 emission
Potential reduction in emissions (tonnes of CO_2 eq.)*#	24,000*	24,278	6000

**extrapolated for chemical sub cluster of 200 units*

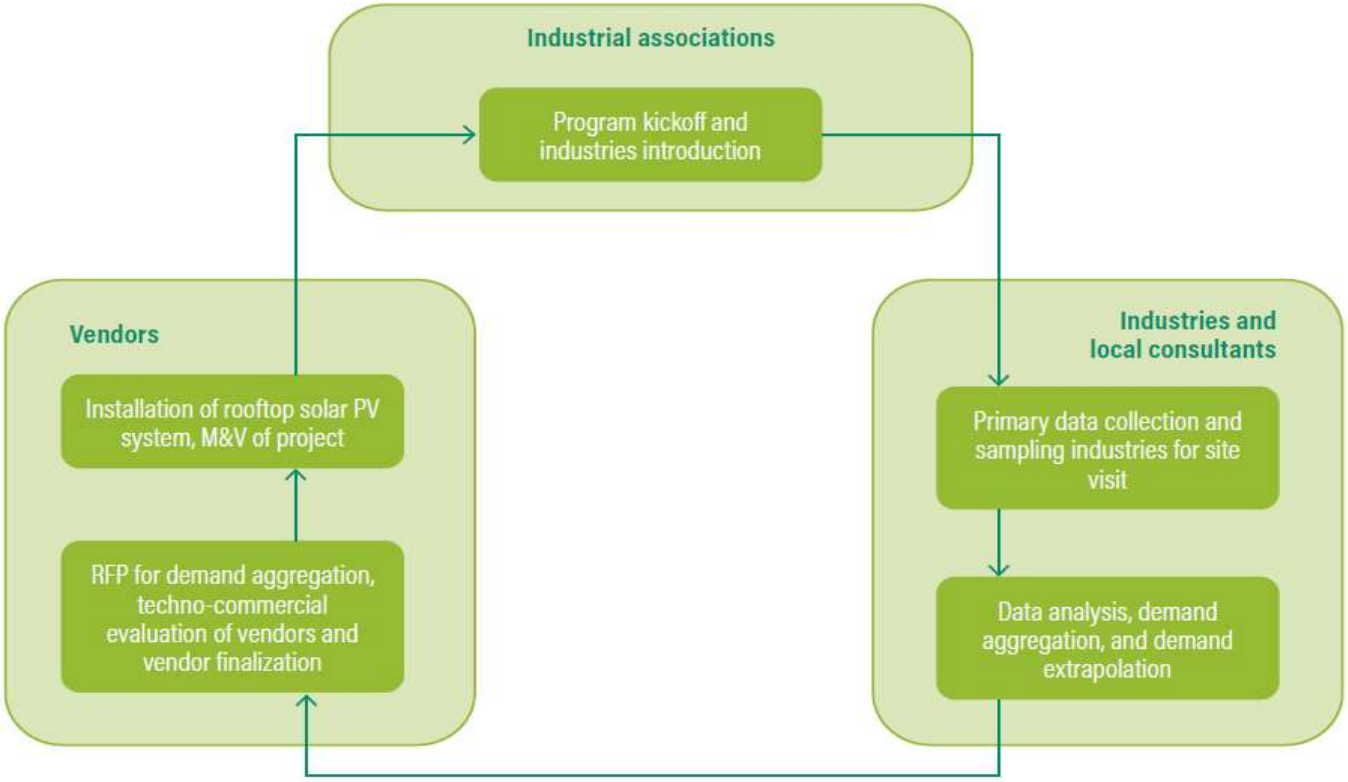
 # - where required this is extrapolated from the sample size that we worked with.

WHILE NOT SUCCESSFUL ON EE, THERE WERE LEARNINGS

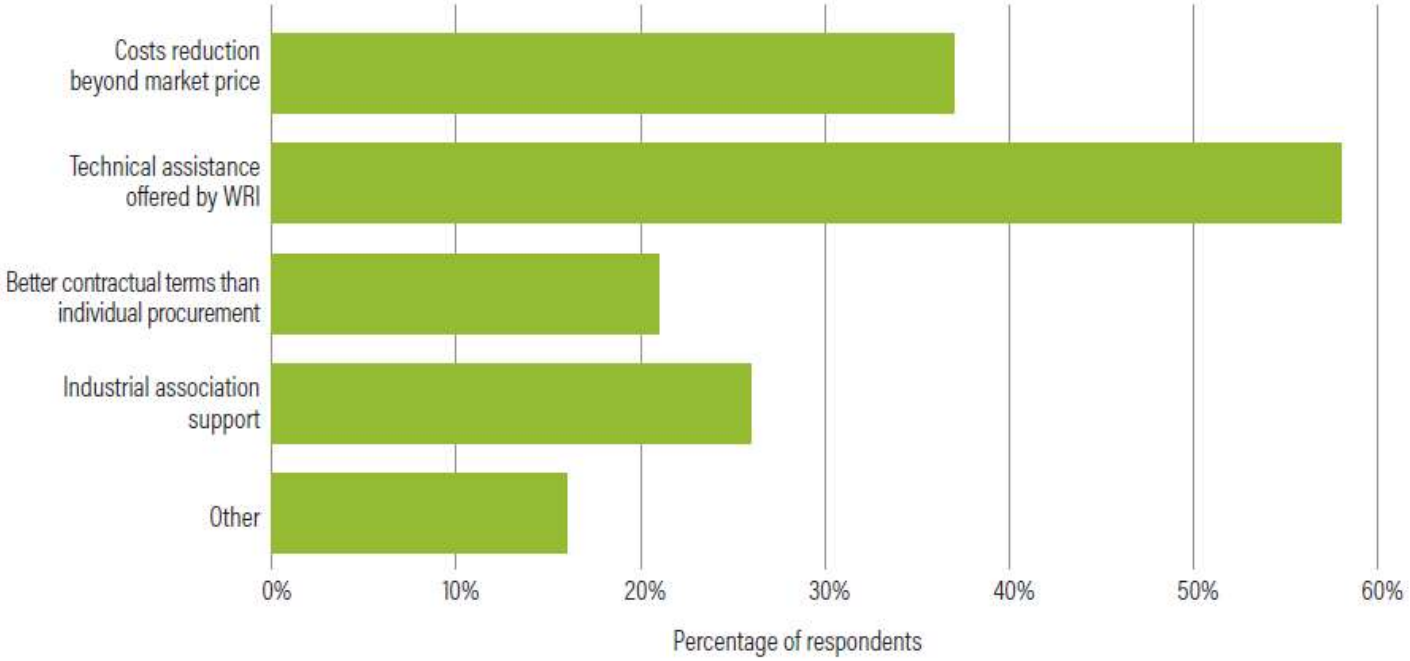
- Ownership and control over the constituent industries are a key determinant in factors like data collection
- Location of units plays a great role when it comes to RE interventions

CASE STUDY: ROOFTOP SOLAR – NARODA AND AURANGABAD

KEY STAKEHOLDERS AND THEIR ROLE



MOTIVATIONS TO JOIN THE DEMAND AGGREGATION

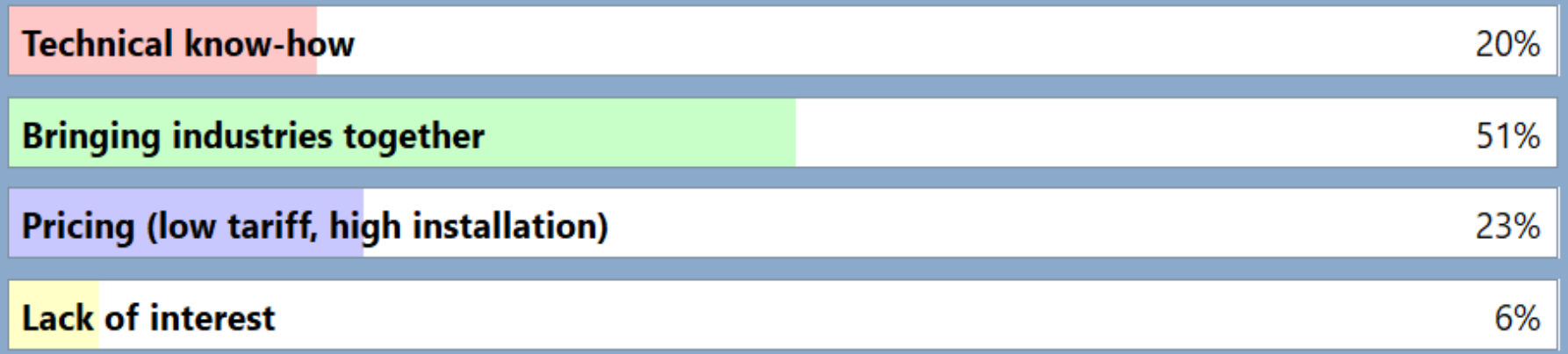


INFLUENCING FACTOR

- The following factors are critical to the successful implementation of the demand aggregation for solar PV systems project:
  - Technical Awareness
  - Securing the support of and working closely with the industries and association
  - Transparent vendor selection process
  - Presence of a local partner
  - Infrastructure and logistics challenge
  - State regulatory commission policy

E.5 If you have to take-up demand aggregation in you cluster, what would be the key challenges you may face?

Poll Results (single answer required):



THANK YOU

Question and Answer Session I

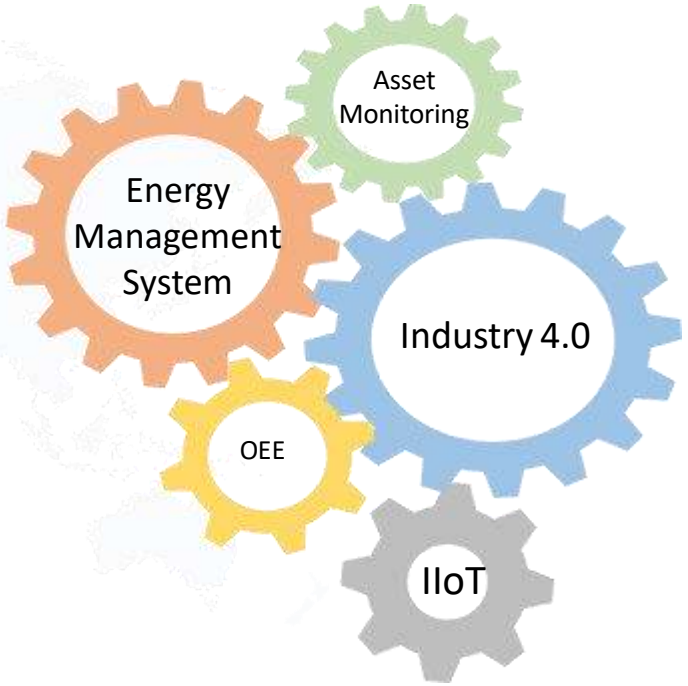
IoT/AI SOLUTIONS FOR ENERGY EFFICIENCY

Vinit Kulkarni, *Co-Founder, Greenovative Energy Solutions*


Uncover
Energy
Intelligence
Greenovative
www.greenovative.co.in

Introduction

- Equips the organizations with **technology & data analytics**
- Asist to **thrive sustainability** and **reduce Opex**
- At least top 3 clients from **every major sector** with Successfully deployed at over **200+ facilities** across India & MEA region



We continue to maximize efficiency and improve long-term reliability for our clients on a day-to-day basis

Value Proposition & Underlying Magic

"uncovers Energy Intelligence through data and technology helping customers consume less energy, improve system utilization, increase reliability & generate insights to help optimize resources & achieve sustainability"

Proudly Serving At . .

AUTOMOBILES

TATA MOTORS
Mahindra MAHINDRA AUTOMOTIVE
MAGNETI MARELLI
TVS Sundram Fasteners Limited
MAHLE
BAJAJ
neosym success through synergy CK BIRLA GROUP
SPICER DANA
SIGMA ELECTRIC MANUFACTURING CORP.

TEXTILE

RR Raymond
NTC NATIONAL TEXTILE CORPORATION LIMITED
BILT BILTWARA GROUP PROUD TO BE INDIAN PRIVILEGED TO BE GLOBAL
Nitin Spinners Limited
sutlej textiles and industries limited
JP TEXTILES

PHARMA

CADILA PHARMACEUTICALS LIMITED
Zydus dedicated to life
amneal PHARMACEUTICALS
Encube
LUPIN
MERCK
NOVARTIS

STEEL

JSW Steel
ESSAR STEEL
ISPAT Balasore Alloys Limited
ELECTROSTEEL
العربية للانابيب ARABIAN PIPES

FOOD & BEVERAGES

المراعي Almarai
JUBILANT LIFESCIENCES
Carlsberg
PRIVILEGE
BACARDI
Coca-Cola

Proudly Serving At . .

FACILITIES & INSTITUTES

CEMENT & OIL

CHEMICALS, PAINTS EXPLOSIVES

TYRES & PLASTICS

HEAVY INDUSTRIES & OTHERS

Many More...

Key Metrics & Recognition

Diagnosing **1 Billion+** energy unit every hour

Maintenance Cost Reduced by **6%** *($0.12 Mn*)*

Amplified equipment uptime by **14%**

Decrease in energy consumption by **12-15%** *($5 Mn*)*

Maintaining reports complied with **ISO 50001**

Increased Productivity Throughout up to **8%**

Member of MCCIA

Assisting IMC in Egypt

Greenovative

Recognized member of Department of Industrial Policy and Promotion (DIPP) India

- Smart Startup of the year 2020 by **India Smart Grid Forum** For power quality at **EV charging station**
- Winner of BIZ Arena by **Proctor & Gamble** 2019
- Winner – **Emergx** "Highway to a 100 Unicorns" – **Microsoft for Startups 2020**
- Winner of Maharashtra **Start Up Week** 2018, India

Offerings

Energy Management System(EMS)

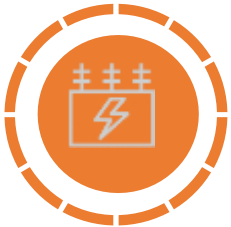
- GreenErgy: Real time Energy data monitoring software solution
- Improves system utilization
- Increases reliability
- Predicts performance of electrical & mechanical systems

Overall Equipment Efficiency(OEE)

- Improves manufacturing processes
- Identifies losses
- Measures and improves performance of machines/operators

Asset Monitoring

- Maximizes ROI on CAPEX
- Ensures uptime of assets
- Ensures reliability and safety of assets
- Empowers proactive actions for system failures



Smart Grid

- Identifies areas of wastage T&D Losses
- Transformer Monitoring & ticketing
- Power Quality at EV charging Stations
- Analytics of electrical patterns to improve grid stability

Illustration & Benefit

Application Hosting

Central Server

OR

Cloud Server

Smart Devices

Desktop Computer

Tablet PC

Smart Phone

Laptop

Benefits

In-depth Reporting

Daily, Weekly, Monthly, Quarterly, Yearly, SEC, ISO50001

Advanced Analytics

Demand Calculations, Loss analysis, machine running hours, alerts, and events

Integration of Multiple Systems

Create hassle free user access to a single platform

Cost Savings Reduction in

Energy Consumption, Enhanced Productivity, Reduction in breakdown

EMS Architecture On Cloud /Enterprise Server

2 core shielded co-axial cable

Daisy Chain Topology

IoT Gateway

Cloud Server

Enterprise Server

Or

'GreenErgy' hosted in IIS environment at cloud/ Enterprise server

Water Flow meter, Steam Meter, Energy Meters, sensors, etc.
Data collection and central Physical or Cloud server hosting
Multi make and model of devices connected

Data Collection from connected Devices/Sensors at specified intervals

2 core shielded co-axial cable

Daisy Chain Topology

IoT Gateway

Data Collected from all Devices/sensor is stored in Microsoft SQL Server

Smart Devices

Desktop Computer

Tablet PC

Smart Phone

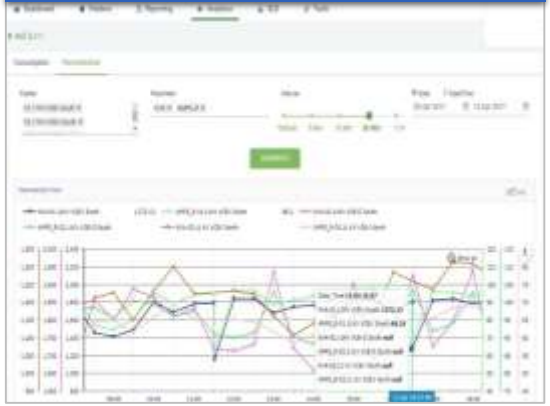
Laptop

Sample Screens https://www.mysmartems.com/

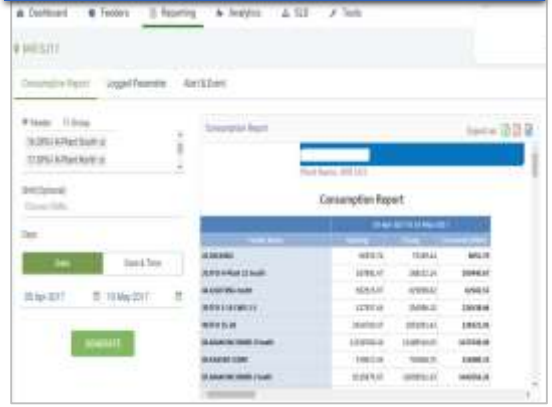
Dashboard

Smart Sensors

Data Analytics



Reporting



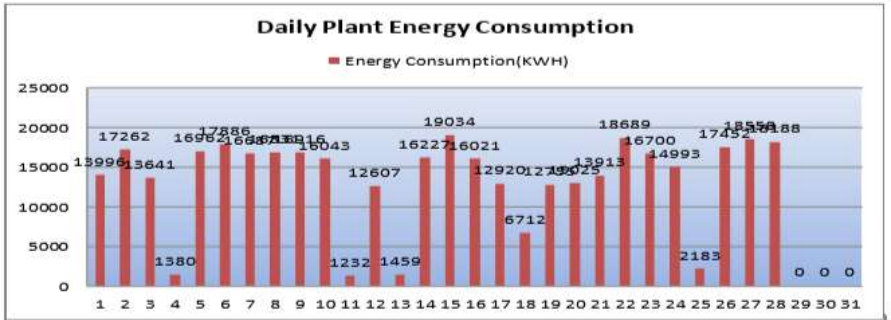
Single Line Diagram

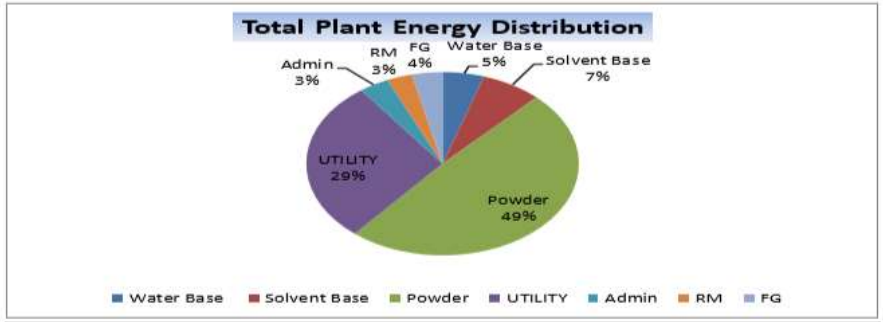
Alerts & Events

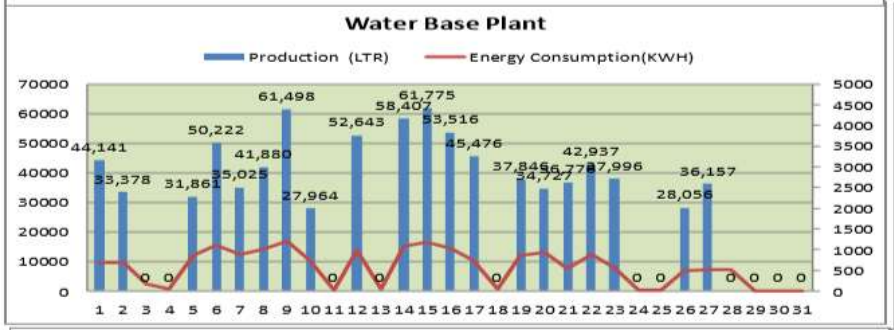
Specific Energy Consumption Report

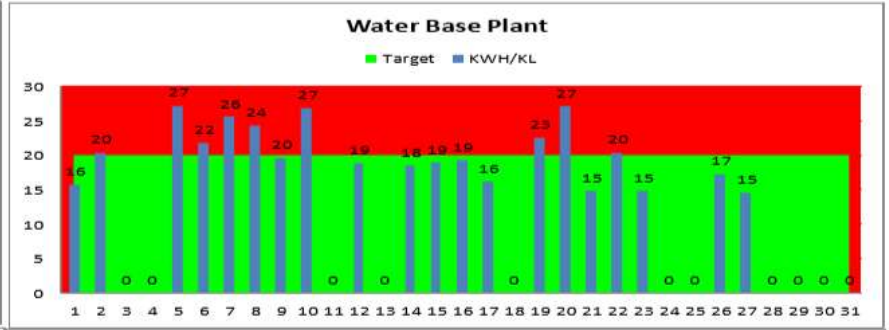
Date	Product 1 (KL)			Product 2 (KGS)			Product 3 (KL)			UTILITY	Total Manufacturing	Admin	RM	FG	PLANT	PLANT
	Energy Consumption(KWH)	Production (LTR)	KWH/KL	Energy Consumption(KWH)	Production (KGS)	KWH/KGS	Energy Consumption(KWH)	Production(LTR)	KWH/KL	Energy Consumption (KWH)	KWH	KWH	KWH	KWH	Energy Consumption(KWH)	KWH/KL)
1	693	44141	16	6003	13470	446	1534	49572	31	3892	12122	468	429	526	13996	131
2	678	33378	20	8034	24365	330	1345	23723	57	5069	15125	521	423	510	17262	212
3	174	0	0	6857	19725	348	771	0	0	4120	11922	433	388	322	13641	692
4	48	0	0	222	0	0	186	0	0	13	468	295	137	246	1380	0
5	864	31861	27	7594	23190	327	1673	48215	35	4702	14834	501	444	505	16962	164
6	1097	50222	22	8238	26835	307	1505	38760	39	4878	15718	494	495	584	17886	154
7	895	35025	26	7706	25420	303	1533	45385	34	4321	14455	466	463	607	16687	158
8	1015	41880	24	7601	21880	347	1464	45385	32	4560	14639	493	455	533	16831	154
9	1204	61498	20	7678	23120	332	1683	29399	57	4444	15009	449	390	525	16916	148
10	749	27964	27	8472	26470	320	869	10800	80	4220	14310	382	368	424	16043	246
11	34	0	0	266	0	0	126	0	0	85	511	259	129	203	1232	0
12	988	52643	19	5567	13020	428	1284	24958	51	4101	11941	448	414	514	12607	139
13	50	0	0	252	0	0	183	0	0	34	519	329	141	257	1459	0
14	1079	58407	18	7169	21305	336	1184	33097	36	4569	14001	484	459	544	16227	144
15	1170	61775	19	9659	29110	332	988	37374	26	5017	16834	520	463	529	19034	148
16	1032	53516	19	7238	19425	373	1110	53758	21	4427	13807	517	461	583	16021	126
17	733	45476	16	6104	21140	289	200	0	0	4359	11397	401	372	296	12920	194
18	42	0	0	3933	13590	289	183	0	0	1983	6141	187	153	148	6712	494
19	855	37846	23	6550	26740	245	728	25450	29	2861	10994	480	425	480	12755	142
20	940	34727	27	7150	28265	253	444	29887	15	2644	11178	510	390	519	13025	140
21	544	36776	15	6874	17680	389	907	37034	24	4199	12524	463	407	519	13913	152
22	875	42937	20	9044	26620	340	753	45623	16	5231	15903	548	528	626	18689	162
23	563	37996	15	7401	21970	337	1137	46337	25	4507	13608	636	467	586	16700	157
24	17	0	0	7413	18430	402	462	23370	20	4546	12438	511	433	485	14993	359
25	17	0	0	357	0	0	20	0	0	310	703	417	153	302	2183	0
26	485	28056	17	8205	25175	326	1076	42385	25	4758	14524	591	477	565	17452	183
27	528	36157	15	8365	25695	326	1457	51782	28	4958	15307	590	485	582	18558	163
28	528	0	0	8038	0	0	1201	0	0	5241	15009	516	544	639	18188	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	17897	852,281		177,990	512,640		26006	742,294		104050	325,943	12,912	10,896	13,158	0	
	Water Base Paint						Solvent			UTILITY						

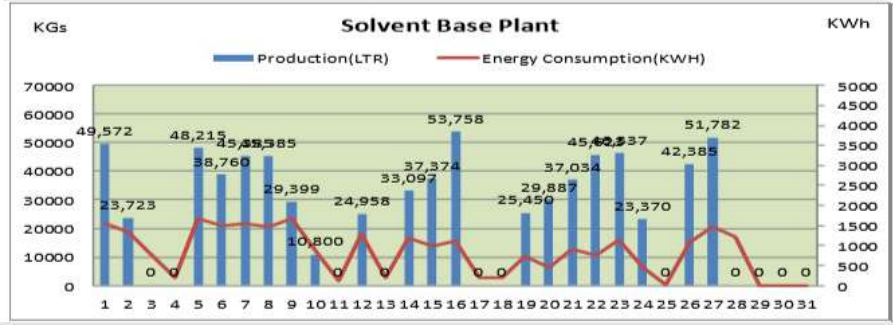
Customized Dashboard

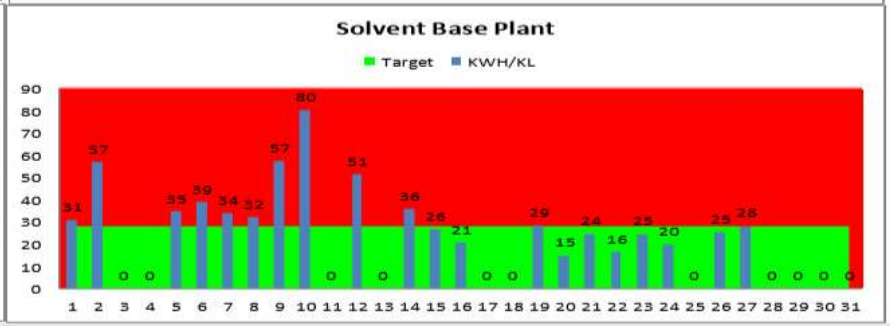






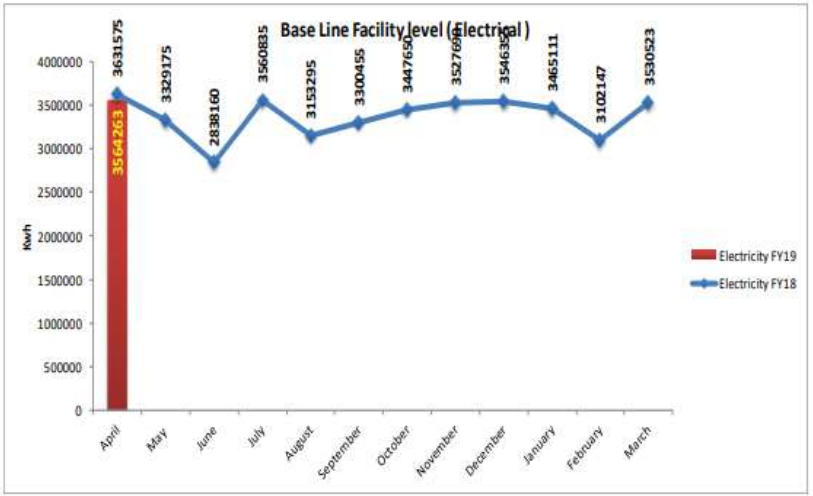


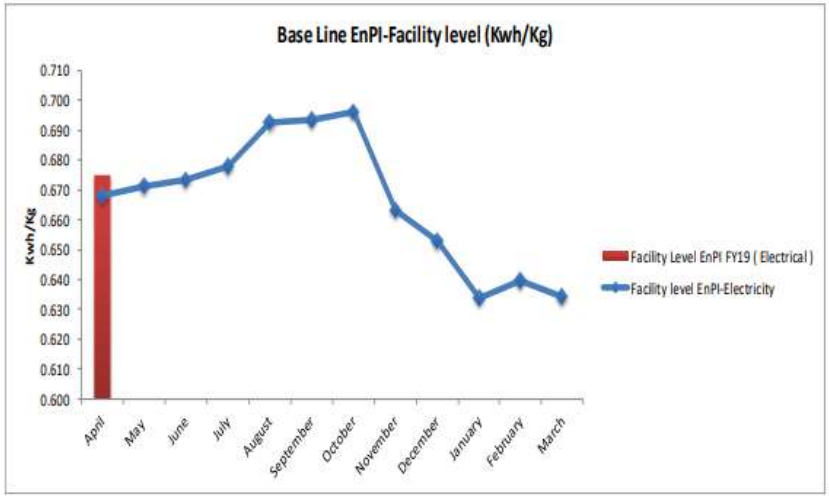




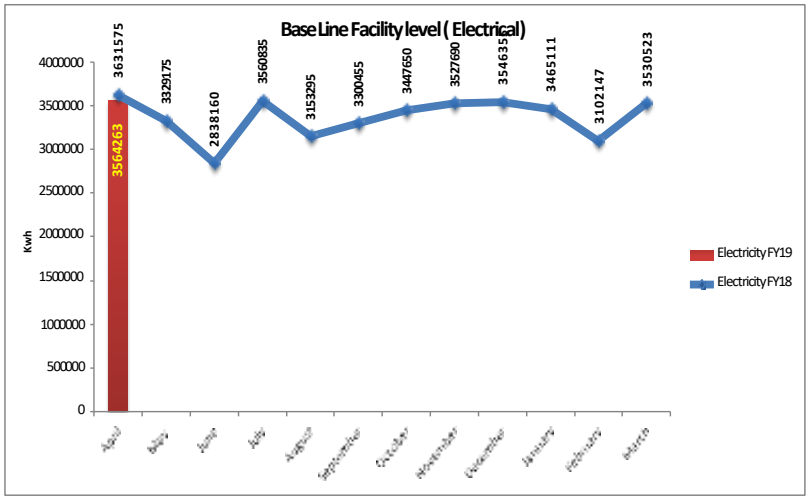
ENPI Report

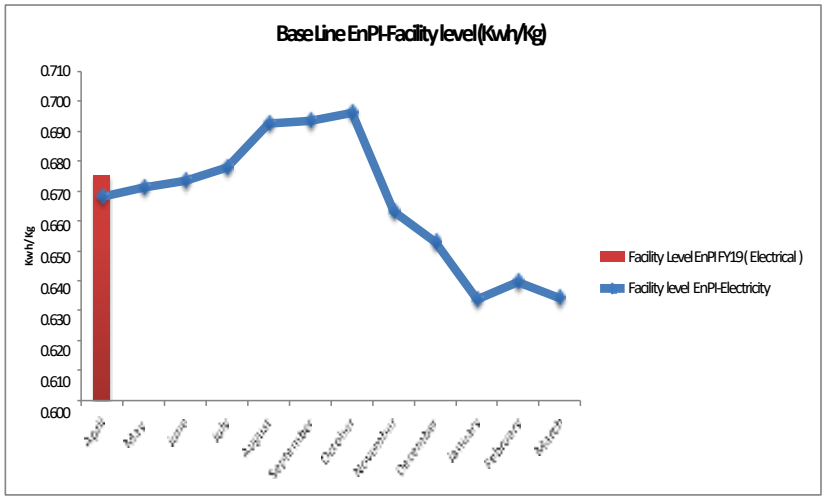
Fuel	April	May	June	July	August	September	October	November	December	January	February	March
Electricity FY17	3579450	3625745	3783423	3882875	3589065	3432105	3406805	3467100	3568515	3499694	3188986	3679129
Electricity FY18	3631575	3329175	2838160	3560835	3153295	3300455	3447650	3527690	3546355	3465111	3102147	3530523
Electricity FY19	3564263											
Facility level EnPI-Electricity	0.668	0.671	0.673	0.678	0.693	0.693	0.696	0.663	0.653	0.634	0.639	0.634
Facility Level EnPI FY18 (Electrical)	0.649	0.668	0.727	0.689	0.722	0.689	0.697	0.671	0.674	0.658	0.653	0.647
Facility Level EnPI FY19 (Electrical)	0.675											
Brequette												
Facility level EnPI (Brequette)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Facility level EnPI (FO)	5281480											
FO EnPI	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Production FY17	5358420	5403367	5619523	5729508	5181370	4949110	4893280	5228380	5464564	5520760	4986800	5800818
Production FY18	5593793	4984620	3906000	5165220	4368413	4791500	4944872	5260644	5262498	5267751	4747470	5458657
Production FY19	5281480											





ENPI Report


Base Line Facility level (Electrical)
Kwh
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
3631575
3564263
3329175
2838160
3560835
3153295
3300455
3447650
3527690
3546350
3465111
3102147
3530523
April
May
June
July
August
September
October
November
December
January
February
March
Electricity FY19
Electricity FY18


Base Line EnPI-Facility level(Kwh/Kg)
Kwh/Kg
0.710
0.700
0.690
0.680
0.670
0.660
0.650
0.640
0.630
0.620
0.610
0.600
April
May
June
July
August
September
October
November
December
January
February
March
Facility Level EnPI FY19 (Electrical)
Facility level EnPI-Electricity

Greenovative

#uncoverEnergyIntelligence

Greenovative Energy Pvt. Ltd.

Plot No. 20, Bhagwati Nagar, Behind Croma Store, Baner, Pune-411045,
Maharashtra, India

Ph.:020 2729 5000, **E:**info@greenovative.com

www.greenovative.com

ENERGY EFFICIENCY IN COMPRESSED AIR SYSTEMS

Hidhay K., *Managing Director, Systel Group of Companies*

Systel’s Industry 5.0 Solutions for Compressed Air Systems

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ABOUT US

An Indo Danish Venture

VISION - TO SIMPLIFY COMPRESSED AIR MANAGEMENT

- 18 Years of Operation
- Over 1600 Compressed Air Projects
- Over 50 Million MWH of Energy Savings
- ISO 11011 Certified
- First to Introduce Industry 5.0 in Indian Market

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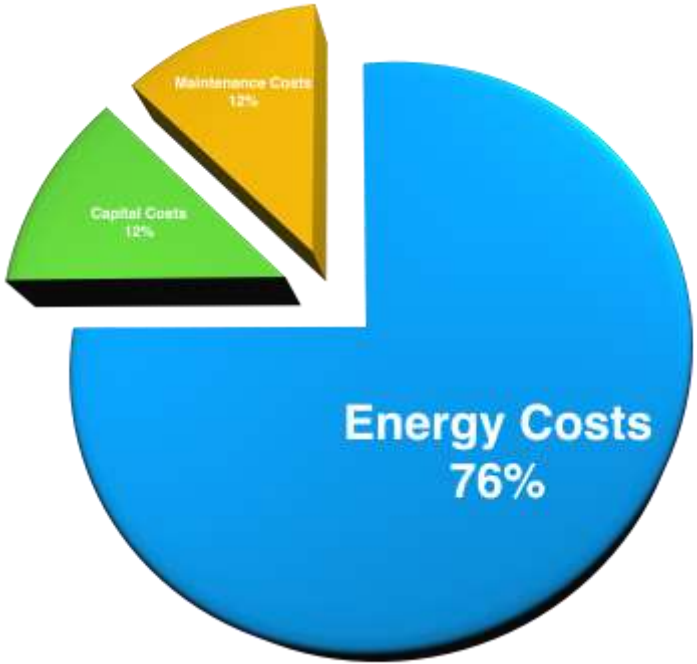
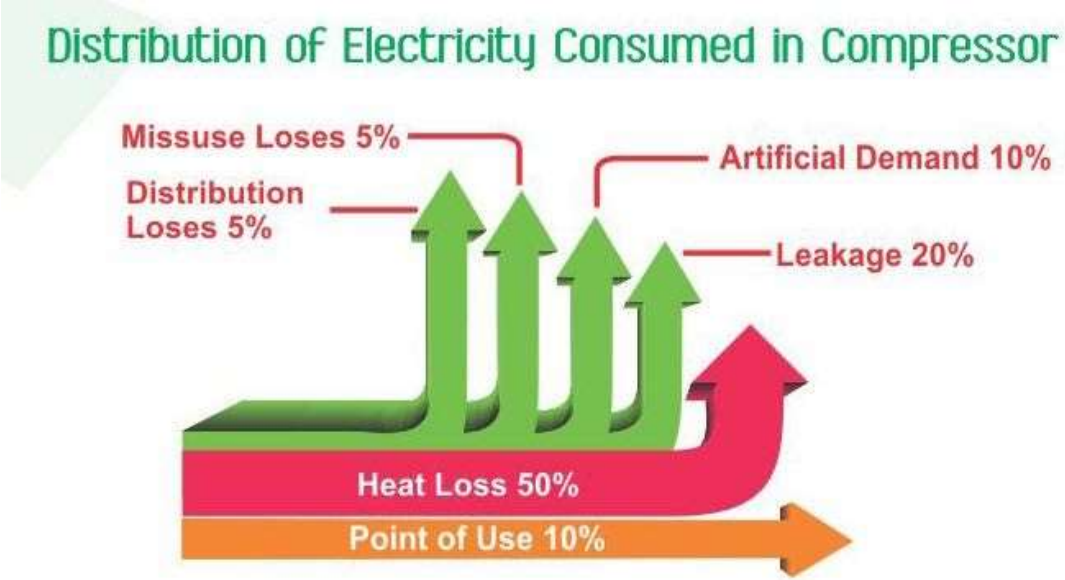
Annual Impact Of A 100 HP Compressors



- 6,48,000 kWh
- Rs 48,60,000 @Rs 7.5 / kWh
- 100 Tons of Green House Gas
- 5.1 Million Litres of Cooling H_20
- 1,04,560 Litres of Condensate
- 2,54,500 Thermal Energy (Btu/hr)

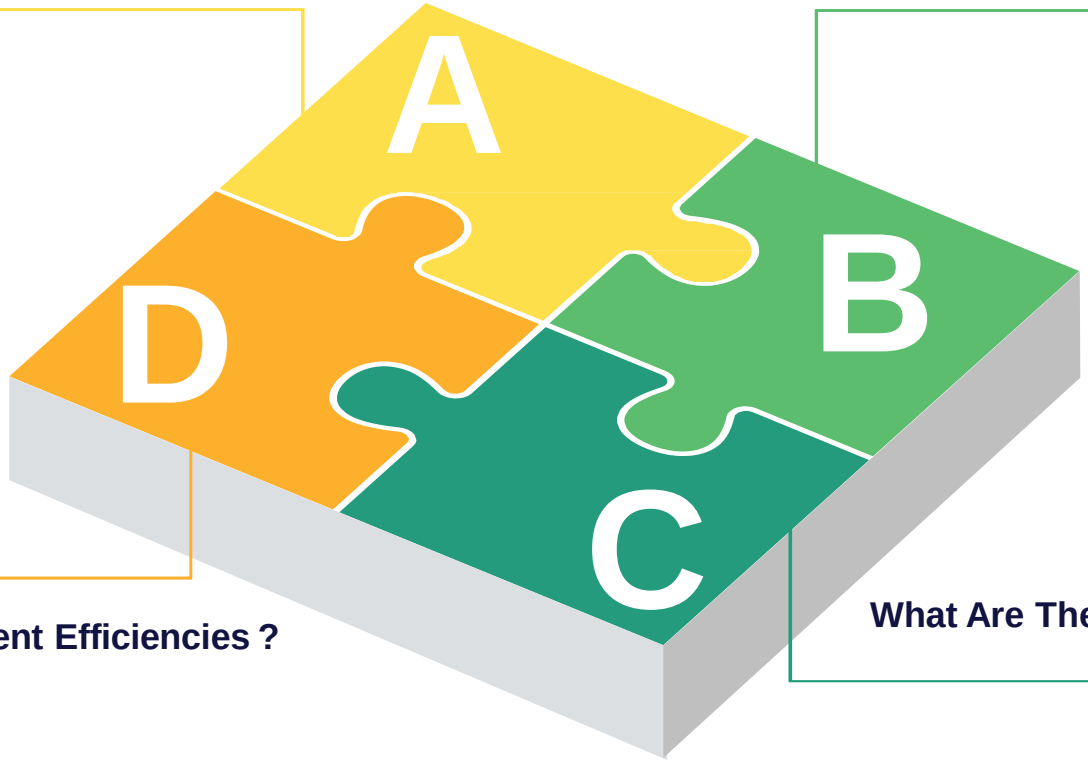
Energy Costs Capital Costs Maintenance Costs


Distribution of Electricity Consumed in Compressor
Missuse Loses 5%
Distribution Loses 5%
Artificial Demand 10%
Leakage 20%
Heat Loss 50%
Point of Use 10%

Compressed Air Puzzles ?

How Much Air Is Produced ?

How Much is The Actual Requirement ?



What Are The Equipment Efficiencies ?

What Are The System Losses ?

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Result of In-Efficiencies

HIGH ENERGY COSTS

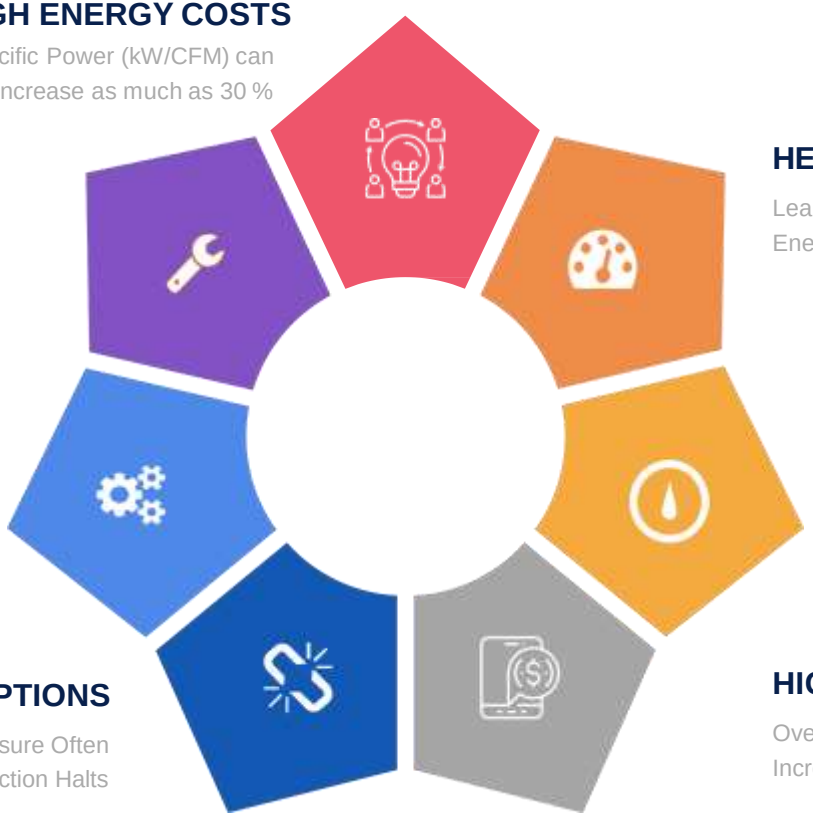
Specific Power (kW/CFM) can increase as much as 30 %

HEAVY LEAKAGES

Leakages Upto 30 % Drain Your Energy & Money

HIGH MAINTENANCE COSTS

Nearly 25 % Increased Costs due to Frequent Wear & Tear



POOR AIR QUALITY

High Contaminants Create Rusting, Scaling in Pipelines and Damage Costly Pneumatic Equipments

FREQUENT BREAK-DOWN

Resulting in the Need for Identical Back Up Capacities

PRODUCTION INTERUPTIONS

Fluctuating System Pressure Often Leads to Production Halts

HIGHER COST OF OWNERSHIP

Overall Operating Costs Can Increase as Much as 30%

Rise Above

Ownership Costs

Save Upto 40 % in Reduced Cost of Ownership

Efficiency

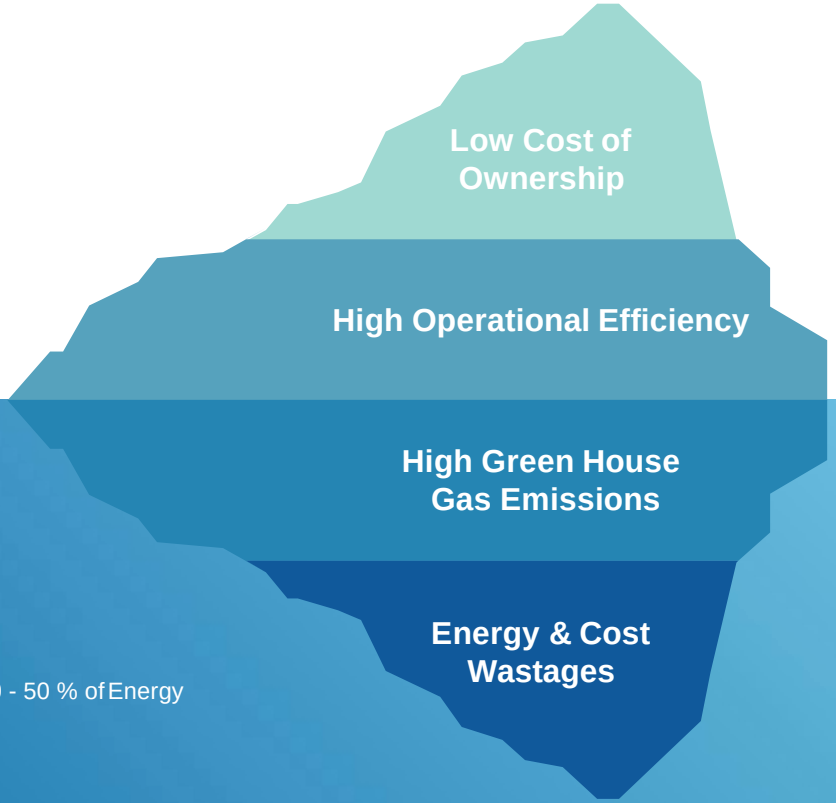
Industry 5.0 Can Help You Achieve Maximum Operating Efficiencies of Your Compressed Air Equipments

Emissions

Every 1 H.P of Compressor Capacity Annually Emits 1 Ton of Green House Gas Emissions

Losses

Inefficient Systems Often Waste As Much As 30 - 50 % of Energy



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Systel

Systematic & Smart Improvements

Deploying Industry 5.0 for Compressed Air Systems

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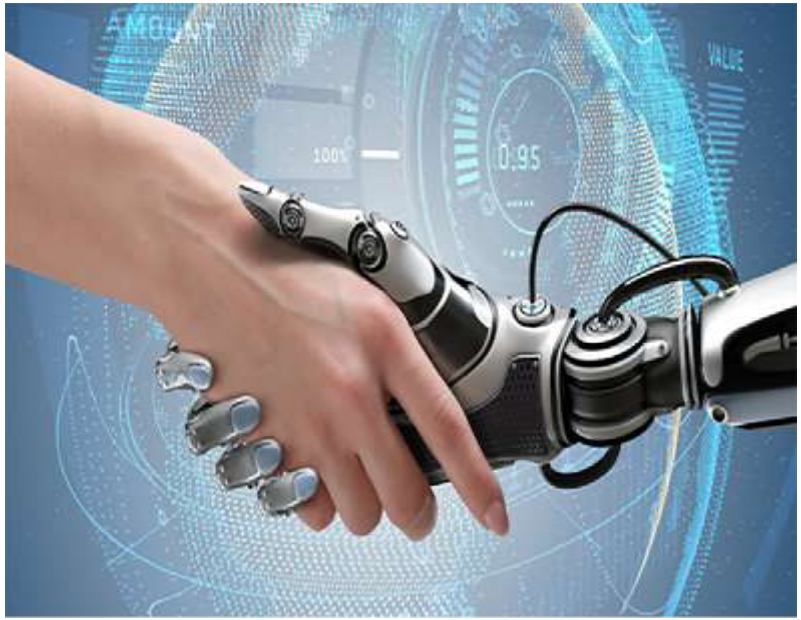
From Wastefulness to Wastelessness

What is Industry 5.0 ?



- The Term Industry 5.0 Refers to People Working Alongside Smart Machines.
- It's About Smart Technology Helping Humans Work Better and Faster by Leveraging Advanced Techniques Like the Internet of Things (IoT) and Big Data.
- It Adds a Personal Human Touch to the Industry 4.0 Pillars of Automation and Efficiency.

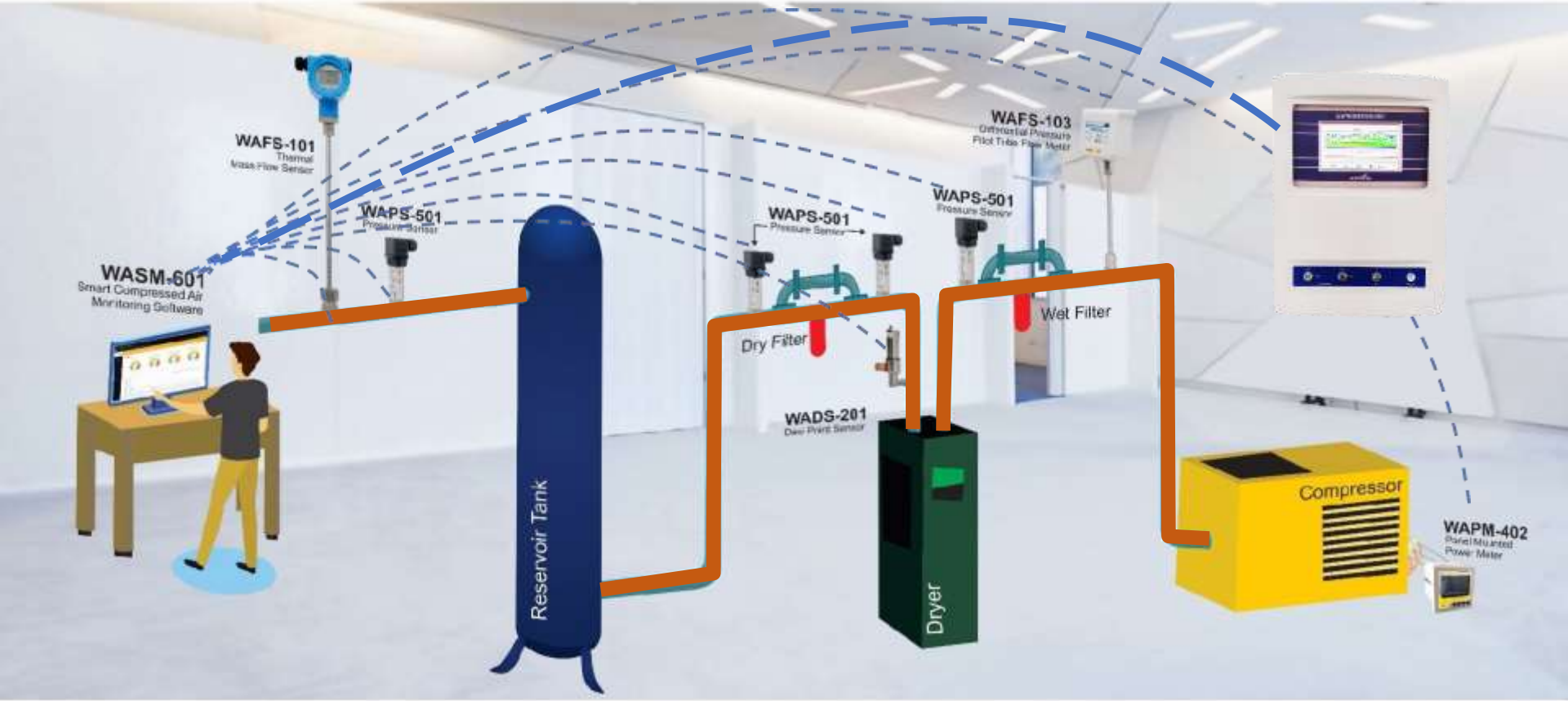
Advancing from Industry 4.0 to Industry 5.0

- The Objective of Industry 4.0 Is to Interconnect Machines, Processes and Systems for Maximum Performance Optimization.
- Industry 5.0 Takes Such Efficiency and Productivity a Step Further.
- It’s About Refining the Collaborative Interactions Between Humans and Machines.

Industry 5.0 - Manufacturing World's Event Horizon

- Industry 5.0 Is Aimed at Supporting – Not Superseding – Humans.
- Industry 5.0 Is About Finding the Optimal Balance of Efficiency and Productivity.
- The Progress of Industry 5.0 Is Unavoidable.

Baselining Operating Data's With Smart Sensors



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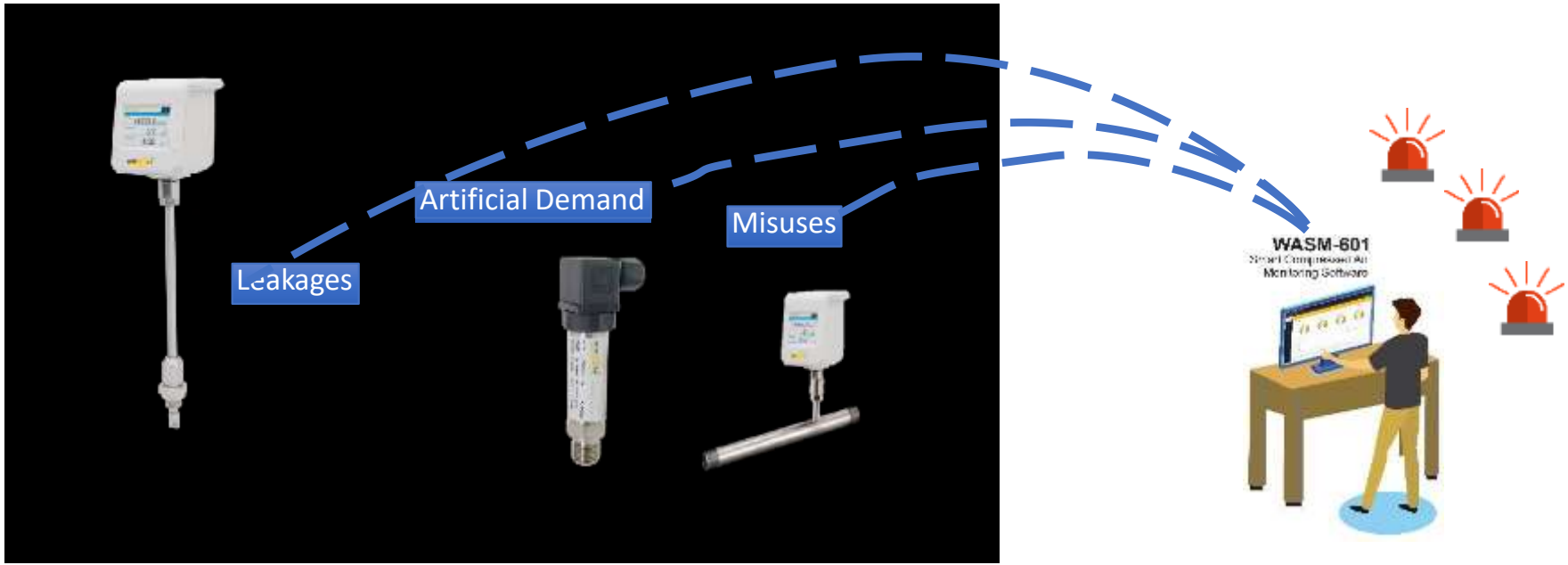
Demand Side Optimization



Define Goals

kW / CFM

Overall System Efficiency Should not Exceed 0.17 kW / CFM

PRESSURE DEW POINT

Should Not Exceed 3 ^{0}CTD for Refrigerant Dryers and - 50 ^{0}CTD for Dessicant Dryers

PRESSURE DROP

Should Not Exceed 0.5 Bar from Wet Receiver to the Actual Point of Use

LEAKAGES

Maintain Leakages at Less Than 5 % of Generation

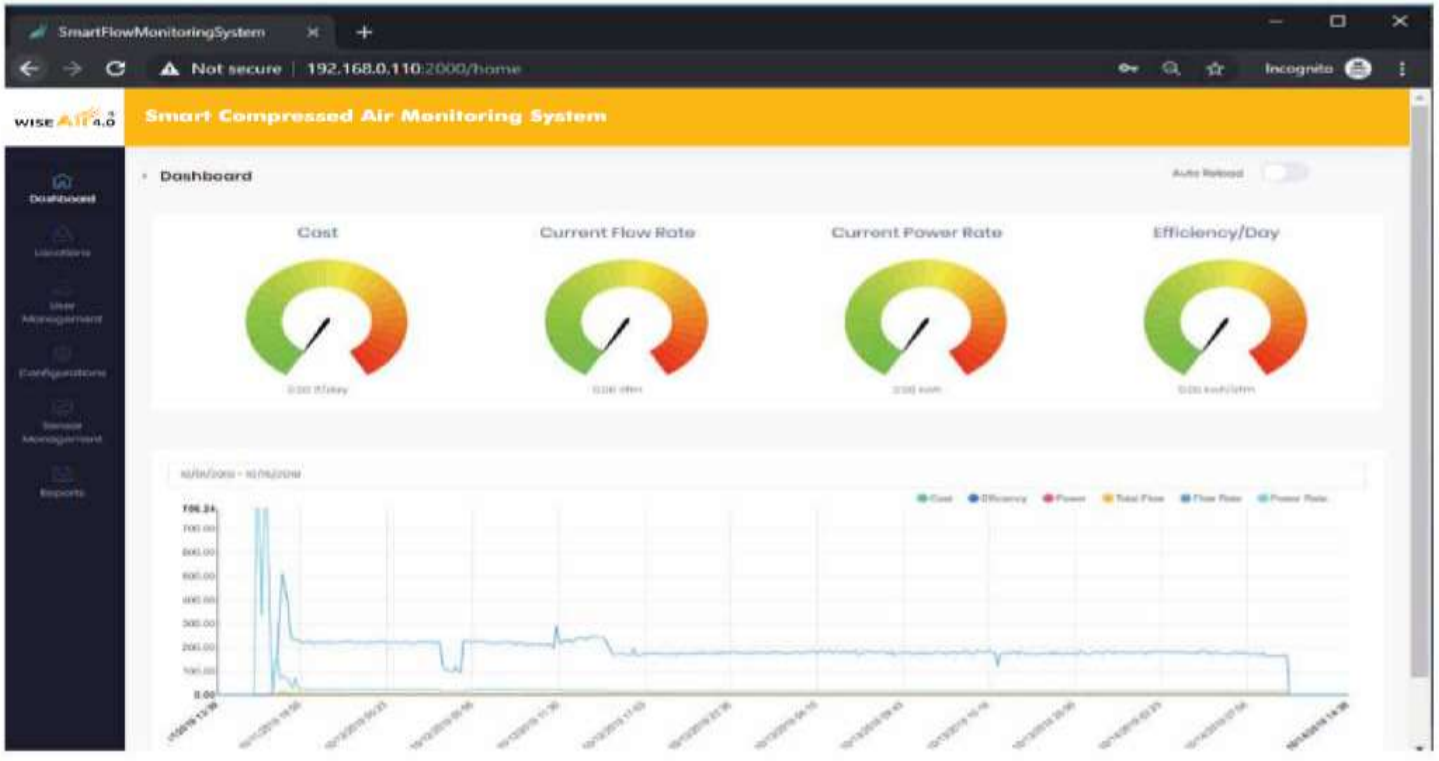
SYSTEM PRESSURE

Maintain Dual Pressure Zones for High & Low Pressure Requirements

Implementing Corrections

Implementing Corrections

Smart Tracking of KPIs



Automated Reports

WiseAir Smart Compressed Air Monitoring System
Consumption Report for Dec 27th 2020, 8:16:08 +0530 to Dec 28th 2020, 8:15:00 +0530
To: Hidhay K

Inbox - Hidhay Systel 8:16 AM

Hello **Hidhay**,

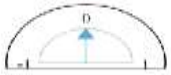
Please find the attached consumption report for Dec 27th 2020, 8:16:08 +0530 to Dec 28th 2020, 8:15:00 +0530

Powered by WiseAir

Sent by WiseAir Smart Compressed Air Monitoring System 1.0

WISE AIR 4.0

SMART FLOW & COMPRESSOR MONITORING SYSTEM

COST (INR)	FLOW	POWER	EFFICIENCY
			

Date	Location-Compressor Hall Flow Rate(cfm)	Total AVG Flow Per Day(Total cfm)	Cost Rate(INR/cfm)	Total Cost(INR/Day)	Total AVG Power Per Day(kWH)	efficiency
26-12-2020	603.04	603.04	0.02	13894.02	102.82	0.17
27-12-2020	610.65	610.65	0.02	14069.47	103.06	0.17
28-12-2020	611.75	611.75	0.02	735.57	103.66	0.17

Case Study - Speciality Steel Plant

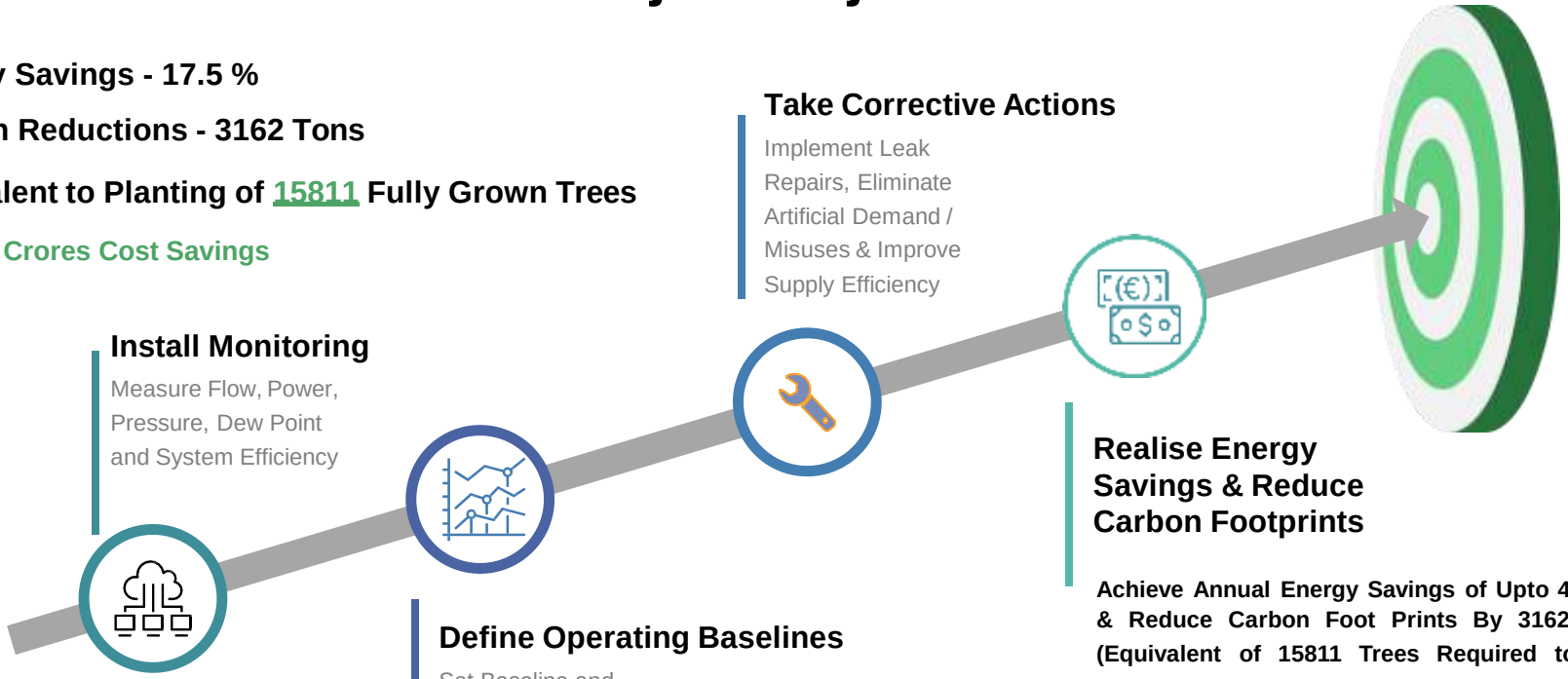
Project Objectives

Energy Savings - 17.5 %

Carbon Reductions - 3162 Tons

Equivalent to Planting of 15811 Fully Grown Trees

Rs 2.32 Crores Cost Savings



Install Monitoring

Measure Flow, Power, Pressure, Dew Point and System Efficiency

Define Operating Baselines

Set Baseline and Define Goals for Improvement

Take Corrective Actions

Implement Leak Repairs, Eliminate Artificial Demand / Misuses & Improve Supply Efficiency

Realise Energy Savings & Reduce Carbon Footprints

Achieve Annual Energy Savings of Upto 488 kWH & Reduce Carbon Foot Prints By 3162 Tons / (Equivalent of 15811 Trees Required to Offset these Emissions)

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Case Study - Speciality Steel Plant

Pressure Measurements at Orifice Plate Flow Sensors		Energy Loss	
Inlet (in barg)	Outlet (in barg)	In kWH	In kWH / Day
6.9	6.7	46	1104

The Return on Investment for installing the 3 Nos of Pitot Tube Flow Sensors was only 83 Days or Just Under 3 Months.

Case Study - Speciality Steel Plant

The Factory loses upto 750 CFM in Air Leakages and thereby Wasting upto 1718 kWH / day.

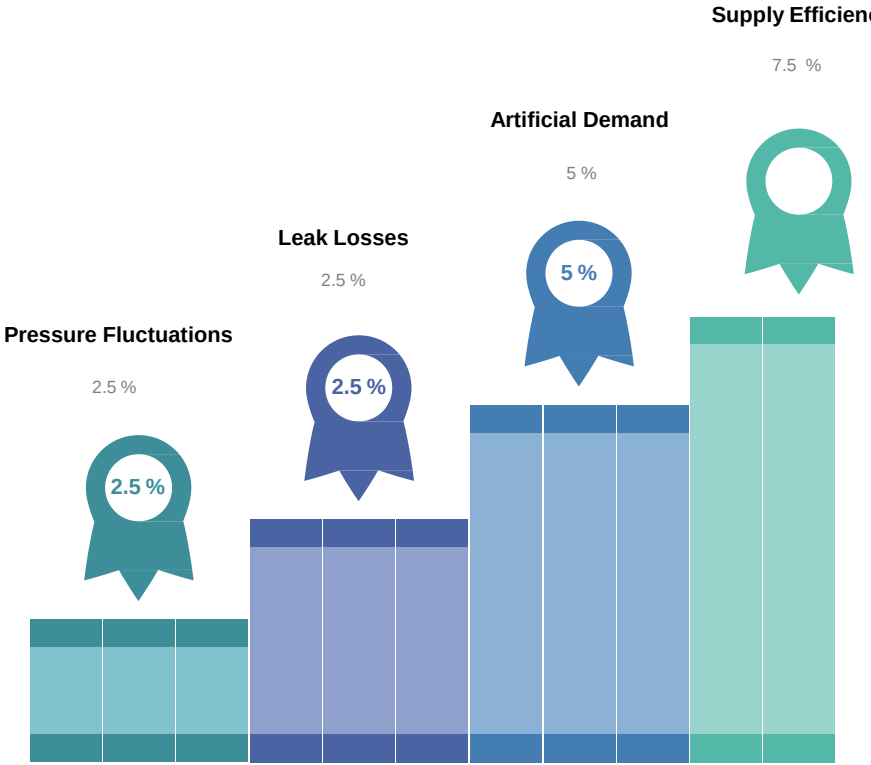
The Return on Investment for installing the 3 Nos of WADS 205 Pressure Dew Point Sensors with Buzzer Alarm and Indicator Lights was only 27 Days or Just Under 1 Month.

Case Study - Speciality Steel Plant

The Plant was forced to increase the Loading Set Points at the Compressor by upto 1 bar resulting in Energy Loss of Upto 1872 kWH / day. Since the Plant was having unregulated pressure usage at multiple production machines, the artificial demand was measured was at 736 CFM or equivalent to 3456 kWH Per Day.

There has been a realised energy savings of upto 1862 kWH / day. PCI Department now works with stable pressure and without any pressure related problems. The Return on Investment for installing 21 Nos of WAFS 106 Smart Thermal Mass Flow Sensors was Just Under 9 Months.

Case Study - Speciality Steel Plant



Energy Savings - 17.5 %

Carbon Reductions - 3162 Tons

Equivalent to Planting of 15811 Fully Grown Trees

Cost Savings - Rs 2.32 Crores

Return on Investment - 6 Months

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ENERGY EFFICIENCY IN HEATING & COOLING SYSTEMS

Navin Kumar and Sandeep Koundinya, *Aspiration Energy and Energy & Emissions Lab, IIT-Madras*

MSME training series #03# – Energy efficiency

Energy efficient innovations in heat pumps.

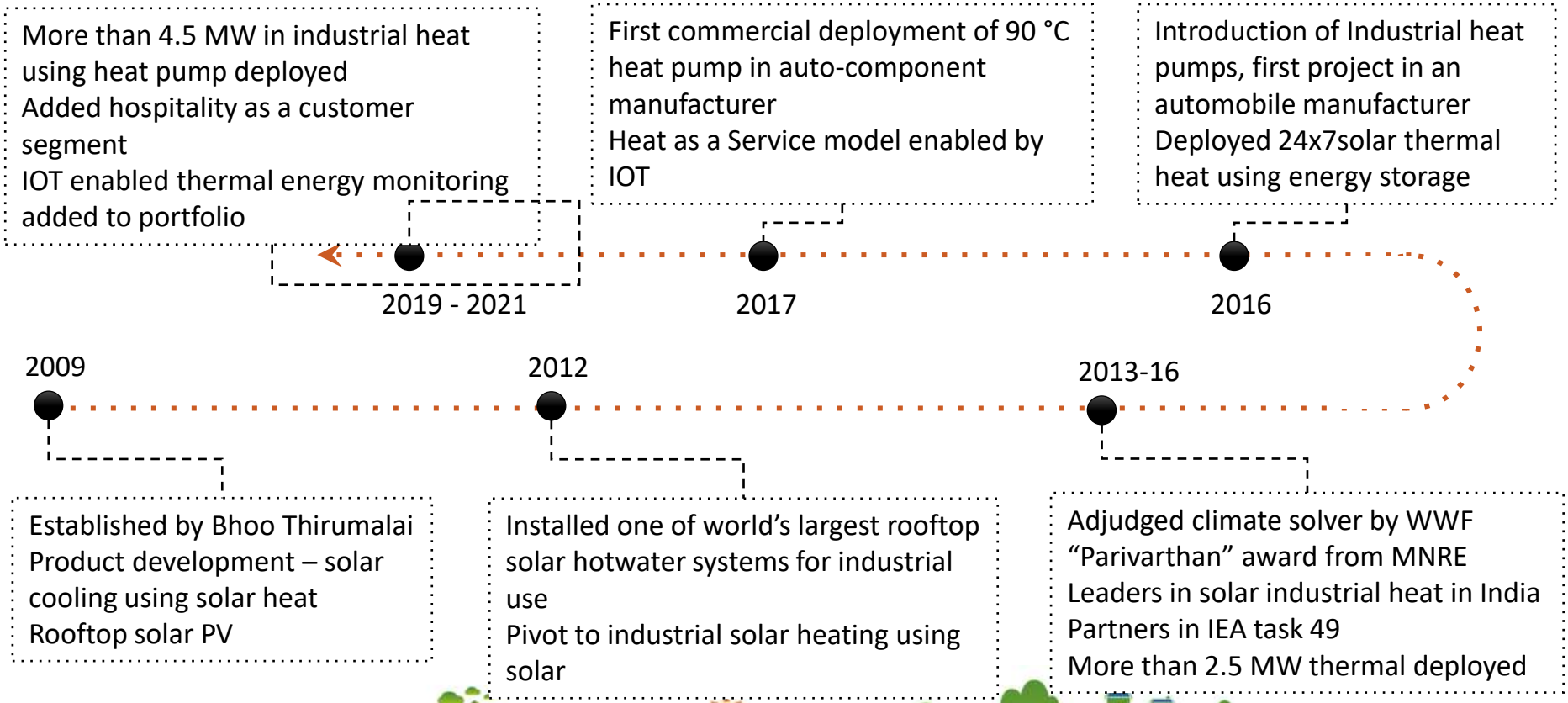
Navin Kumar
Sandeep Koundinya

Aspiration Energy and Energy & Emissions Lab, IIT-Madras

Aspiration Energy

Leaders in Sustainable Heating Solutions

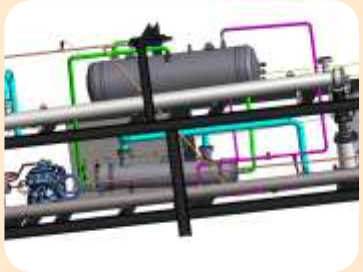
About Aspiration Energy



Product line

Pilot trials…

Coming soon…



ThermaGen Heatpumps

> Up to 90 C process temp

> 3000 kW installed

> Unique rental model for heatpump trials

> Thermal energy PPA

Solar Heating

Up to 90 C process temp

> ~ 2.4 MW installed till date

> India's first 24x7 process heat with thermal battery

Thermelgy - Thermal Energy Monitoring

> Remote monitoring of thermal energy for heat pumps, solar heat and process heating

> IOT enabled billing, health monitoring, preventive health

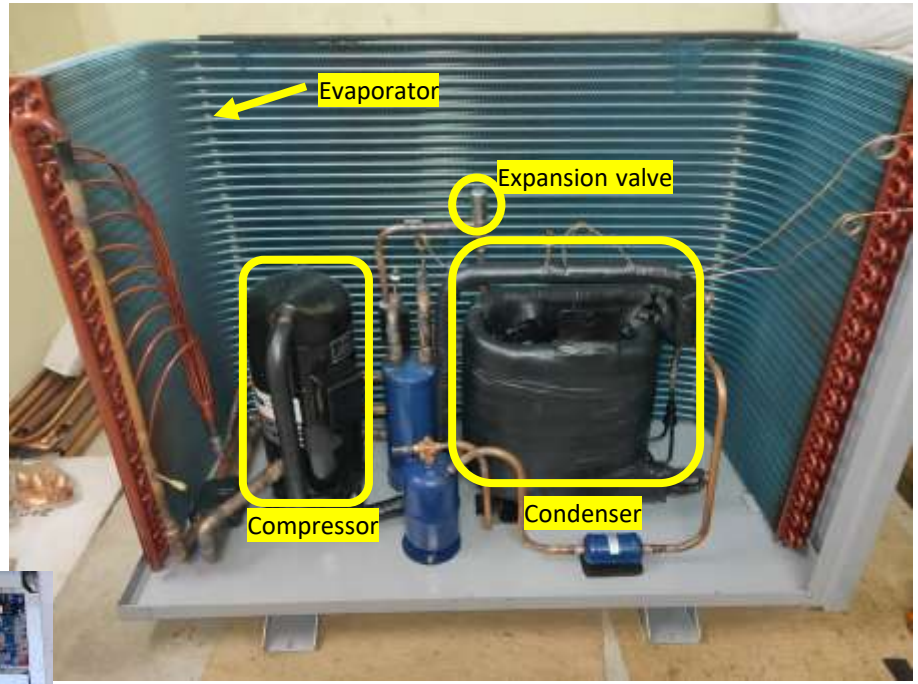
Product innovation

CO2 Heat pumps

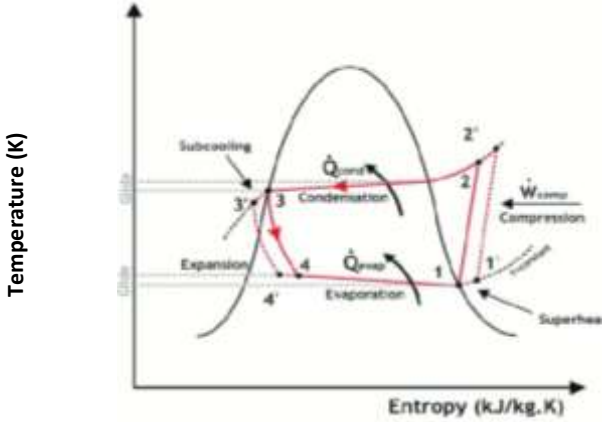
120 C Heat pumps

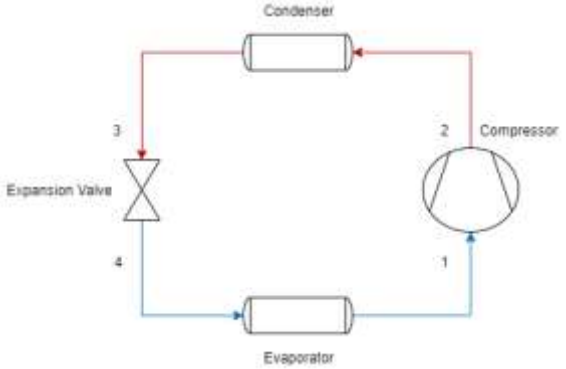
Heat Pump

Industrial Heat Pumps

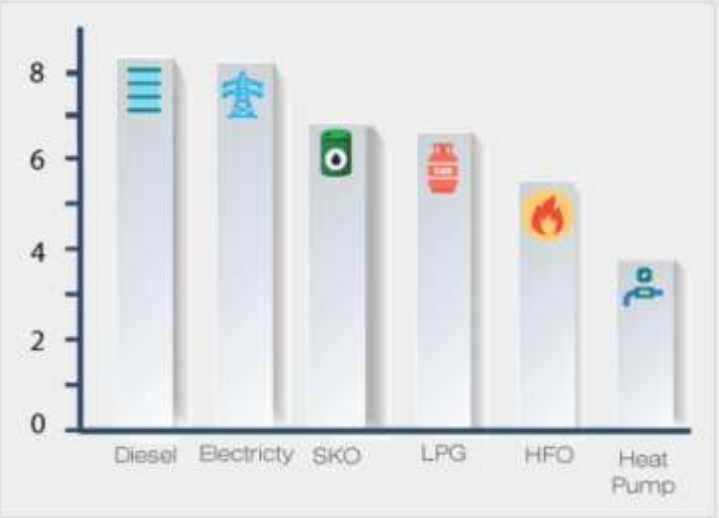


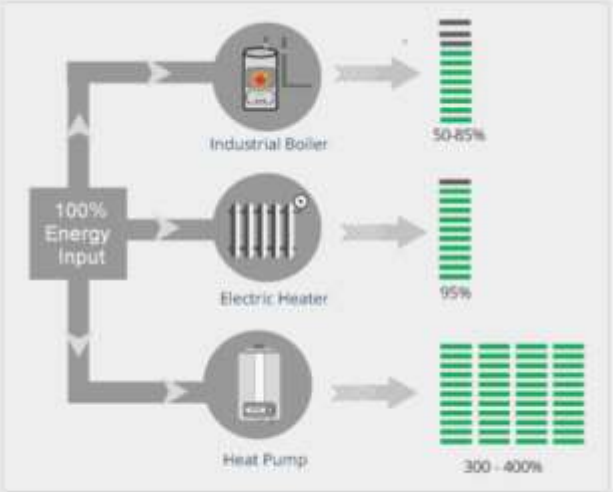
Controller

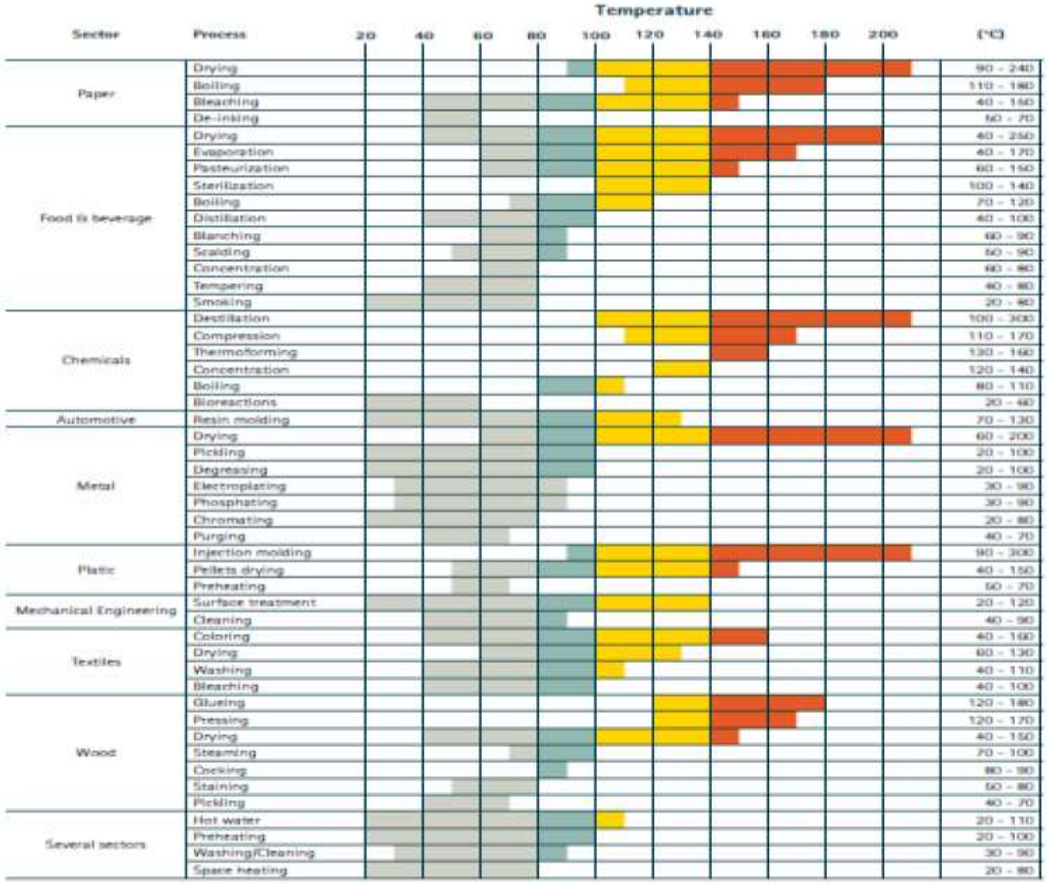




Unit Cost/1000kcal







Source: Arpagaus et al.

Applications

Performance Comparison

DESCRIPTION	BEFORE	AFTER
Heating Solution	Boiler	Heat Pump
Energy Source	LPG	Electricity
Capacity	20L kCal	223k kCal
Operating Costs	Rs.50 / litres	Rs.8 / kWh
Consumption / day	650 kg	1800 kWh

Success Story

Innovation Benefits

Technical

- Heating was used in existing process
- The byproduct cooling from the Heat Pump was also utilized effectively.

Financial

- More than 50% energy savings
- Payback period of less than one year.

Environmental

- Reduction in localized pollution by reduced local CO_2 emissions

Energy Saving calculation:

Sl. no	Particulars	value	Units
1	Avg. LPG Consumption Per Day	650	kg
2	Avg. Chiller Consumption Per Day	700	kWh
3	Thermal Energy used per day for boiler	4420	KWh
4	Electrical energy used per day for chiller	700	KWh
5	Heat pump electrical consumption per day	1800	KWh
6	Total Energy saved per day	3320	KWh
7	Total Energy saved per year	996	MWh

CO_2 Emission calculation:

Sl. no	Emission component	value	Units
1	chiller	195.3	Metric Tons
2	Boiler	590	Metric Tons
3	Heat Pump	502.2	Metric Tons
4	Total emission saved	283	Metric Tons

Cost Saving calculation:

Sl. no	Particulars	value	Units
1	Avg. LPG Consumption Per Day	650	kg
2	Avg. Chiller Consumption Per Day	700	kWh
3	LPG Rate per Kg	50	Rs.
4	Cost of Electricity	8	Rs/kWh
5	Number of Working Days per year	300	days
6	Amount spent for LPG per year	97,50,000	Rs.
7	Amount spent for Chiller per year	16,80,000	Rs.
8	Total amount spent for boiler and chiller per year	1,14,30,000	Rs.
9	Electrical Consumption for heat pump per day	1,800	kWh
10	Amount spent for heat pump running per year	43,20,000	Rs.
11	Total Savings per year	71,10,000	Rs.

Payback calculation

S.no	Particulars	value	Units
1	Avg. LPG Consumption Per Day	650	kg
2	Avg. Chiller Consumption Per Day	700	kWh
3	LPG Rate per Kg	50	Rs
4	Cost of Electricity	8	Rs/kWh
5	Number of Working Days per year	300	days
6	Amount spent for LPG per year	97,50,000.00	Rs.
7	Amount spent for Chiller per year	16,80,000.00	Rs.
8	Total amount spent for boiler and chiller	1,14,30,000.00	Rs.
9	Electrical Consumption for heat pump per day	1,800.00	kWh
10	Amount spent for heat pump running	43,20,000.00	Rs
11	Total Savings per year	71,10,000.00	Rs
12	Investment for Heat Pump	78,08,338.00	Rs
13	Payback	13	Months

Cost of Technology

Typical installation cost/kW:Rs. 10,000/kW-33,000/kW

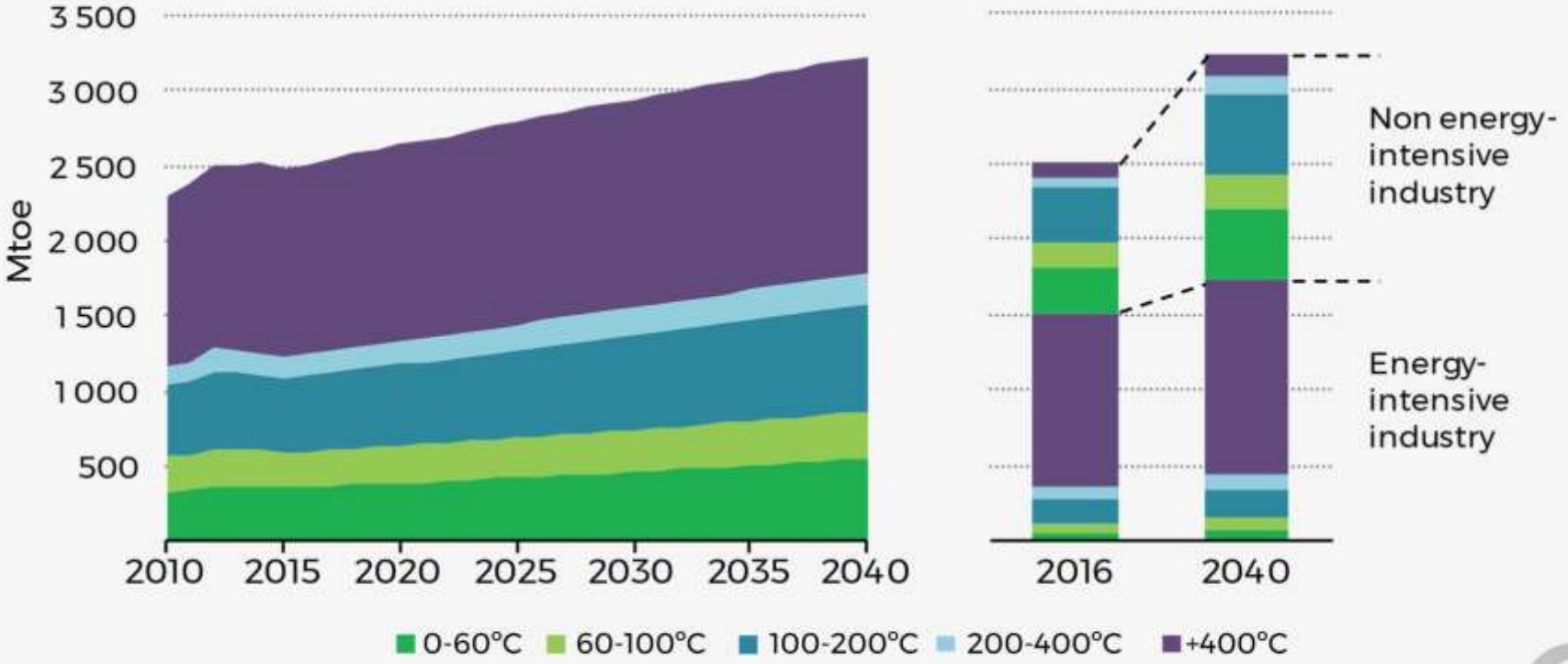
- Depends on: Integration method, hot water delivery temperature, online remote monitoring and diagnostics.
- The project described here was implemented at Rs. 30,032/kW

In most applications, the heat pump system is installed as a hybrid:

- Existing heating source in by-pass or back-up mode
- Direct or indirect heat exchange method:
  - Indirect: additional heat exchanger is integrated with the customer process.
  - Direct heating, process fluid is brought in to the heat pump and returned after heating.

Global industrial demand by temperature level and sector

World Energy Outlook 2017

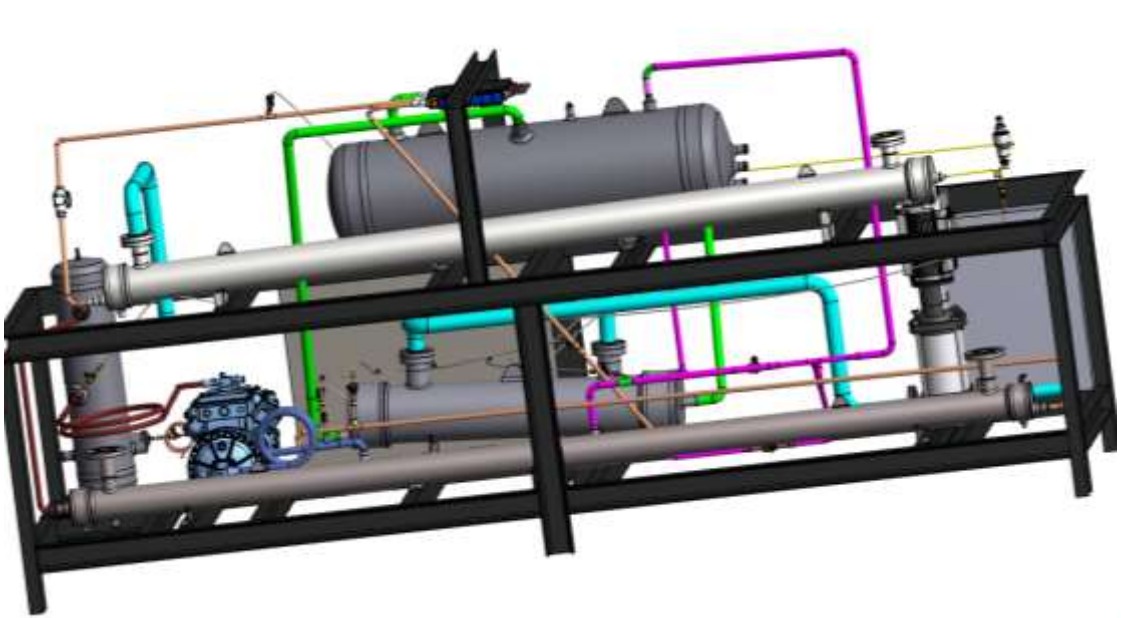


If the heat delivery temperature can be breached beyond 100 C, nearly 40-50 % of the global industrial heat can be served using heat pumps, from < 20% currently

AEPL ongoing Innovations

120 ℃ steam generator

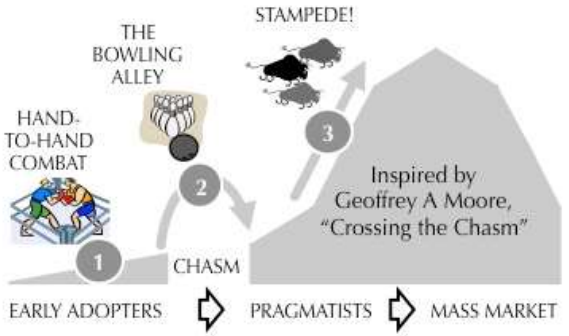
AEPL ongoing Innovations



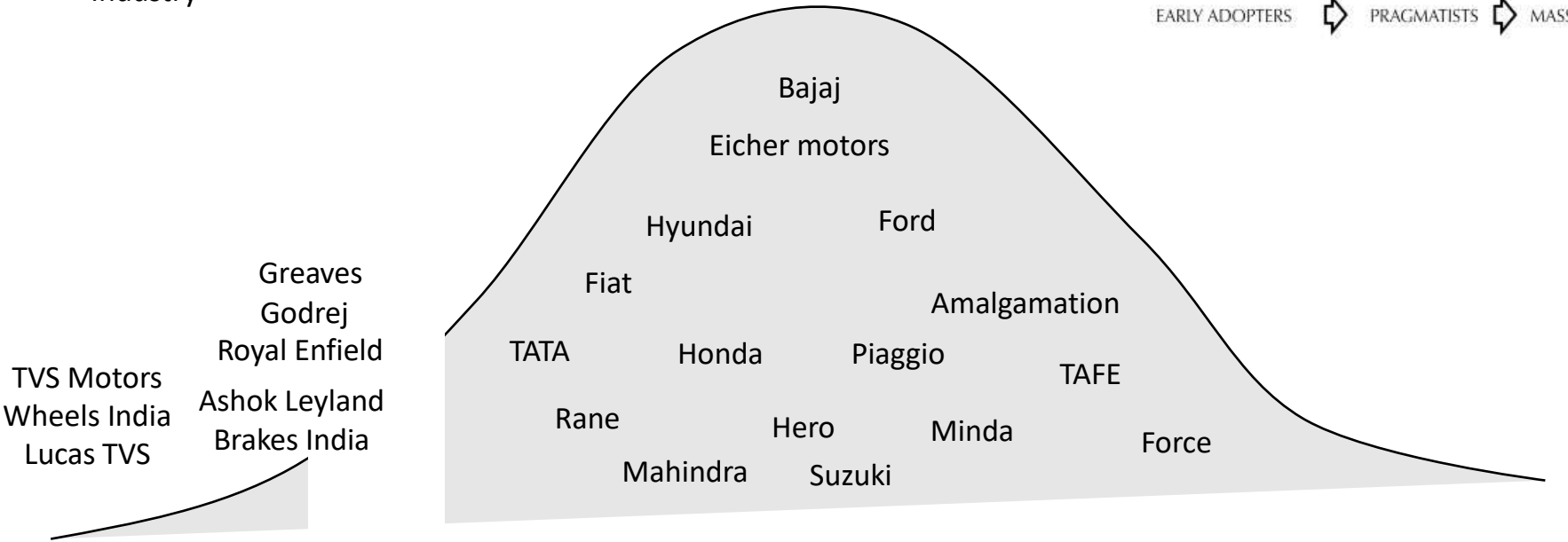
CO_2 Heat pump

AEPL's Chasm

We want to expand to other market segments !!



New segment added: Hotels, Chemical Industry



A Negawatt is better than the Megawatt!!

aspiration energy

>> Leaders in sustainable heating solutions!! >>

Contact us @ info@aspirationenergy.com/044-42185301

Question and Answer Session II

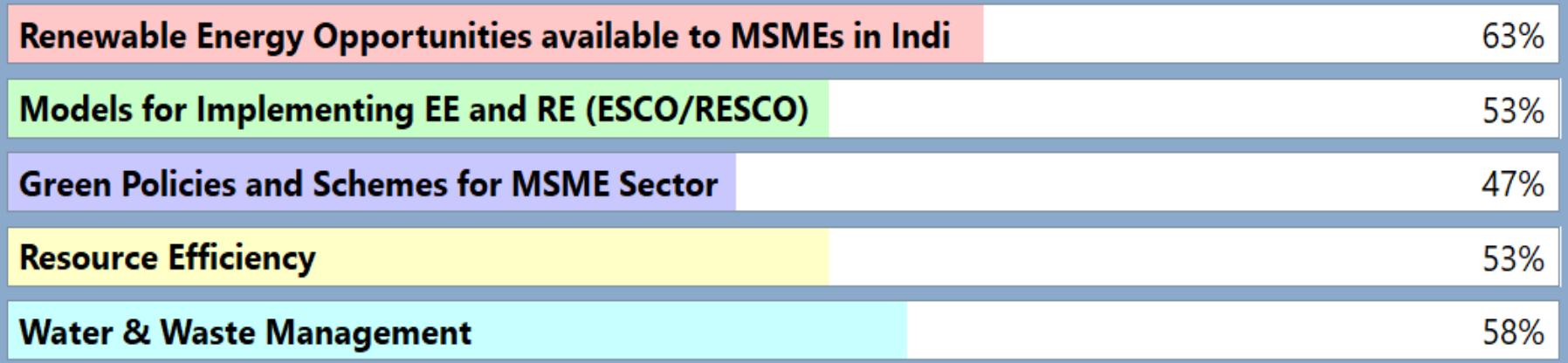
Q&A1 Are you aware of or availed any government scheme for energy efficiency?

Poll Results (multiple answers allowed):

Schemes from Bureau of Energy Efficiency (BEE)	37%
Schemes from Small industrial Development Bank of India (	16%
Schemes from Ministry of Micro, Small and Medium Enterprises	37%
Schemes from State governments	11%
Not aware or availed of any government scheme so far	37%

Q&A2 Which of these topics would you most like to hear about in the next sessions of this training series?

Poll Results (multiple answers allowed):



CLOSING REMARKS

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THANK YOU

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